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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE
AMERICAN MACHINIST PUBLISHING CO.,
256 BROADWAY, NEW YORK.

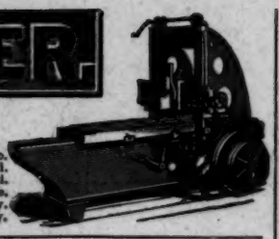
Some Leading Articles in this Number.

Some Personal Reminiscences, by Washington Jones.
Uses and Advantages of a Public Supply of Compressed Air.
Bicycle Hub-Making Tools.
Some Dividing Tools.
Series-Motor Controller and Reversing Switch.
Torque and Counter-Torque.
Power Required for Driving Pipe-Threading Machines.
A U. S. Revenue Cutter Described and Illustrated.

NINETEENTH YEAR.

No. 19.
May 7,
1896.

THE GRAY PLANER.



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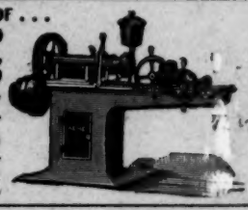

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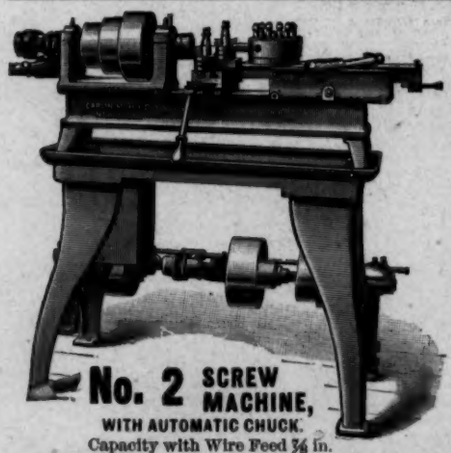

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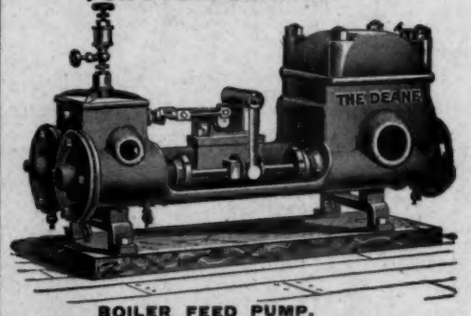

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AMERICAN MACHINIST

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NEW YORK, THURSDAY, MAY 7, 1896.

VOLUME 19. ▲ ▲ ▲ NUMBER 19.

Some Recollections of Machine Shops in the Early Forties.

BY WASHINGTON JONES.

The boilers which were placed on board of the boats spoken of last week, were of the type which Mr. John Bourne, in his treatise on the Steam Engine, facetiously styles "A Yankee Boiler," and as a "Phenomenon," which latter epithet, if meant to characterize its quality as a steam producer, was applied justly. They are in almost universal use at the present time on tugboats, and differ from Mr. Bourne's description only in the substitution of return tubes for flues, and the omission of the worse than useless water bottoms. In the case of those made in the forties, the "assistant" has drawn and redrawn the position of tubes in tube sheets, both on paper and on the tube sheet itself, in the endeavor to squeeze in one or two more tubes to suit the ideas of the "powers that were," when the group was overcrowded already. Experience corrected that, and taught that greater efficiency is obtained by increasing the space between the tubes.

The teaching of later practice is, that the spaces between the tubes should be not less than one-third the diameter of the tubes. This disposal gives wide avenues for circulation of water, and affords room for the bubbles of steam to ascend freely, and without displacing, violently, the water in contact with the tubes; and, consequently, reduces any tendency towards foaming. A desirable way, sometimes used, is to place the tubes on lines radiating from a point some distance below the boiler as such arrangement gives spaces between the tubes, in a horizontal direction, which become greater as the rows succeed each other upwards. That is, the lowest row has spaces of, say, one-third of a tube's diameter; the second row, one-sixteenth of an inch more; the third row, one-eighth of an inch more, and so on. In this disposal, as the quantity of steam bubbles generated on the rows of tubes is cumulative, the spaces for their passage should increase in a certain rate, and thus obviate an accelerated ascent and greater disturbance of the steam-liberating surfaces. The late Chief Engineer Alban C. Stimers exemplified this idea in the boilers of the river monitors; in which the tubes were reduced in diameter as their position in the boiler, on vertical lines, became higher; and, consequently, the spaces between them increased correspondingly. In the first boiler of this type the holes for tubes in one sheet were large enough to allow the tubes to slip through, and in the other sheet the holes were somewhat less than the body of the tubes. One end of each tube was turned down so that a slight shoulder could be had. The tubes were inserted until the shoulder bore against the inner side of sheet, when the projecting ends were riveted over first, and then the other ends. This was found to be unnecessary and was not repeated. Tube expanders were not yet invented.

Amongst the new machines which appeared at this time (early forties) were the Fourneyron turbines, which type was introduced into the United States from France by Mr. Ellwood Morris, C. E. Many of these were built at the Southwark Foundry, and were quite satisfactory as water motors, giving a high percentage of useful effect. They were the forerunners of the turbines now so largely made in the United States. The Southwark Foundry had secured the exclusive right to build the Nasmyth steam hammer, for use in the United States. Many an hour has the "assistant" pored over the self-acting gear, designed by Mr. Nasmyth to suit varying amount of drop to the "tup," in the endeavor to simplify it, and to overcome its perverse disposition to knock itself to pieces—but without success. That was reserved for a later day and for more experienced hands, and on entirely new lines. If the forging of the "Peacemaker" had been made under this type of hammer of sufficient weight, in all probability it would have been thoroughly welded, and its disastrous bursting on the "Princeton" would not have shocked the country. About half of the breach of this gun was brought to the Southwark Foundry for examination, and, if possible, to determine the cause of its failure. The fractured part had not the least fibre, but was granular, with small crystals interspersed. One crystal exposed a face of at least half an inch square. There were evidences of imperfect welding to be seen, and the general appearance of the metal was raw. The Ericsson gun was forged in England and brought over in the rough, and completed at the Southwark Foundry, except the boring, which evidently had been done with a bar, as a hole of about 5 inches diameter was through the butt.

In fitting the breech pin, it was necessary to have the size and shape in the rear of the chamber; in order to get these, one of the slimmest "cubs" was instructed by his foreman what he was to do, and then shoved arms and head first into the bore, which was about 12 feet long and 11½ inches diameter—rather a confined space in which to fit gages for the diameter, and shape of chamber. A little consideration of the matter would have shown that all the measurements required could have been found without sending a boy into such a cramped place. It is most likely that accurate measurements were not obtained, but they were sufficiently near the truth for roughing; and that the final adjustment to place was done by grinding in.

The gun was discharged some hundreds of times, but no observance of gases escaping past the breech pin was made. Indeed, none could possibly escape, even if the butt of the pin did not fit the chamber, for the shank had a threaded end upon which the cascabel was screwed; and as its fitting was done in the "open," every opportunity was had to make a tight joint.

Just here it seems pertinent to allude to "scraping," now such an essential operation in the production of accurate surfaces. Then, the file was depended upon to reduce high spots, marked by red lead spread upon a board of panel stuff, as flat as pattern-makers' planes could make them. Just fancy their use in a first-class machine shop of the present day!

The breech of the Ericsson gun was reinforced by wrought-iron rings shrunk on. One clause of the specifications required these rings to be bored so that sufficient expansion to slip them into place would be had by immersing them in hot water! This condition was waived, and permission obtained to heat the bands in a charcoal fire until they took on a light-blue tint. The expansion obtainable by heating to the temperature of hot water would have been not quite $\frac{3}{100}$ of an

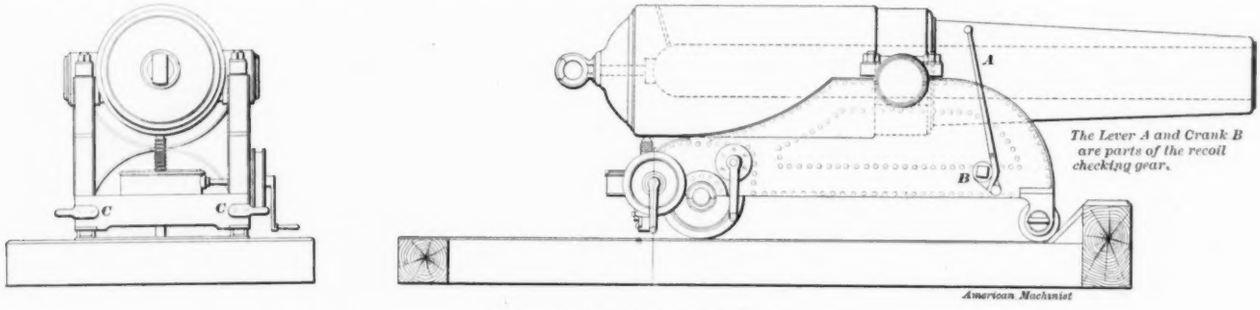
inch. Those familiar with such operations can readily see that such a small margin for shrinkage would require most expert handling of the rings to get them into position on the body of a cold gun; but in a clear charcoal fire the temperature of 600 degrees was had, and a consequent expansion of $\frac{1}{16}$ of an inch, which allowed ample time to do the work before the rings cooled down to their normal diameters. The purpose of the specifications, probably, was to limit the contraction of the rings upon the body of the gun to just sufficient to insure a slight strain. However, that is a condition consequent upon the difference in diameters of the parts when at the same temperature; and if that difference be observed, the piece to be shrunk on may be heated to any degree less than that at which scale will form.

One or two cases are recalled where cranks have "nipped," by accident or awkwardness, before reaching their position, but were released by subjecting them to an application of hot foundry metal, retained in a dam of sand built on a section of the hub. A much better plan is to use a hydraulic press and force the parts into place, as ample time can be had for the work, and no emery papering is needed to remove the discoloration produced by heating. This plan was adopted by the Port Richmond Iron Works in their contract with the Reading forge to finish and put together the shafts, pins and crank-throws for the engines of the American Steamship Company's fleet—"Pennsylvania," "Ohio," "Indiana" and "Illinois;" and it proved so satisfactory that the same plan was used on all built-up crank shafts made subsequently at those works. In fact, there seems to be uncertainty as to parallelism of pins and shafts in built-up crank shafts when the heating and shrinking on of the throws is employed; for the seizure of the cooling parts upon the cold parts may not be simultaneous, and if so, distortion is very likely to follow. And, in addition, the "forcing-in" process is much less expensive.

One or two amusing incidents which happened in the "Chalk Age" were related to me by a participant, Mr. T. Holloway, who in his day had almost a monopoly in Philadelphia of building engines for river steamboats. His shop was equipped with but few machine tools. All the steam cylinders of his engines were bored in a lathe whilst lying in a horizontal position. The cutter-head was fed by a screw turned by hand. On one occasion an apprentice (now the head of a large machine works) was set to "feed up," which, being rather a monotonous job, gave him opportunity to ponder. Being of an ingenious disposition, the result of his thought was to place a star wheel on the feed gear which would engage itself at each revolution of the bar with a pin and cause the feed screw to turn sufficiently to advance the cutter the proper distance for a fresh cut. (This is now a well known device.) In one of his rounds, Mr. Holloway saw this arrangement and asked questions, and finally said: "Jacob, one of the laborers can attend to this; you go and fit up the steam chests"—an example of ingenuity appreciated and rewarded, which recalls the story of Humphrey Potter and his device for moving automatically the steam valves of the Cornish pumping engine which hitherto had required his close personal attention.

Another of the ancient legends is: Mr. Holloway secured the contract for an engine, against the bid of an establishment which turned out carefully fitted machinery. One who was interested in the latter, spoke of the disappointment to himself, caused by the failure of his establishment to get the order, and concluded his remarks: "And his rough-and-tumble engines—confound them—work as well as ours, although we take so much pains in fitting them up." Now, the truth is, the men who made their mark in those early days were born mechanics, and to them can be applied a paraphrase of the quotation, "Poëta nascitur non fit." They possessed sound judgment and an intuitive perception of proportion, which qualities more than compensated for lack of intimate knowledge of the "science of quantities," and it is doubtful if they ever felt the loss, or cared for what has been jocosely termed "mathematical millinery."

As the Ericsson gun "Oregon," and its carriage, have been alluded to, I send a drawing of it, made after hours and by candle-light; hence some "slips of the pen."



ERICSSON'S GUN "OREGON."

A Contributor's First Experience.

"The first article I wrote appeared in the 'American Machinist,' January 15, 1881. As the circumstances connected with this introduction of my first attempt at writing may influence others who are now too backward to make a similar attempt, I will take space to recite them. There is one thing about practical literature, no matter what subject may be discussed—it almost invariably displays shop experience, and presents something that can be practically applied to benefit someone in the business. It was this thought that caused me to yield to solicitations from my friend, Mr. John Doolittle, a machinist, to commence writing, and send an article to the 'American Machinist.' He seemed to think I would be successful, owing to the character of the sketches and notes he observed I had collected in my travels, of shop wrinkles, receipts, etc. Soon after mailing my first article to the 'American Machinist' it appeared in a very attractive form, covering the whole of the front page. I was not prepared for such an introduction. I felt I wanted to commence, if such was to be, in an unattractive manner. I always started in at the back when watching for the article; and when I saw what greeted my gaze in the number containing it, I gave the page a fling from me, with feelings of embarrassment, criticism, responsibility and gratification all intermingled in such confusion that I did not attempt to read the article, but straightway hunted up my friend Doolittle to tell me what he honestly thought of it, as I held him responsible for getting me into the dilemma I felt that the prominence of the article had placed me in. 'Why,' said I to John, 'I have not anything more to write about, and such publicity will cause them all to be chasing me up and bothering the life out of me.' I shall never forget his reply, which was an order for me to go home, open my sketch box, use my brains, and let him see an article from me every week or two, or else he would disown me."—Thos. D. West, in "The Foundry."

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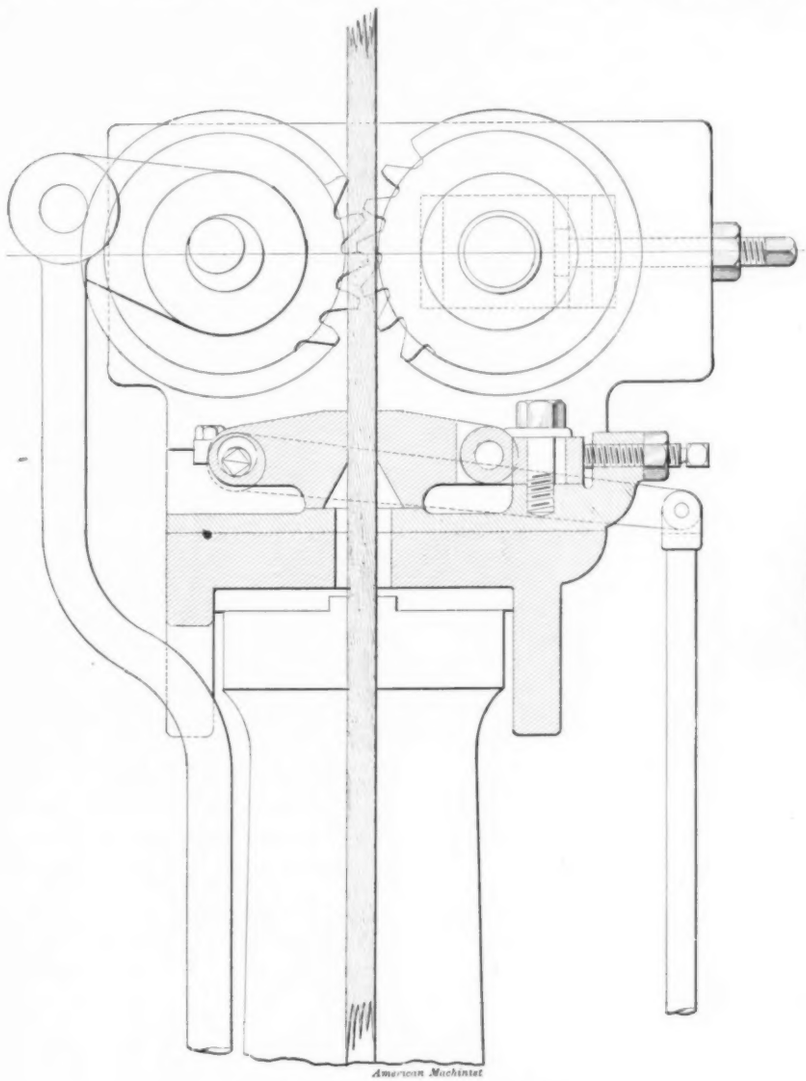
It is thought that the coarser kinds of cotton goods will soon not be manufactured in England, and the cotton industry there seems to be passing through a crisis.

The Latest Design of Stiles Hammer.

The half-tone given herewith shows the newest design of 1,500-pound Stiles friction-roll drop hammer, built by the E. W. Bliss Co., Adams street, Brooklyn, N. Y. A sectional view showing the



LIFTING MECHANISM OF DROP HAMMER.

mechanism of the lifter is also given, and it requires no explanation. This hammer differs from former models mainly in the proportions of parts and in the weight of the whole machine. These drops are built with 1,000 and 2,000 pound hammer heads and also in smaller sizes.

The tendency is more and more to the use of heavier hammers, and to do with one blow what heretofore has required several, evidently pointing toward increased economy and efficiency. The anvils are now made from twelve to fifteen times the weight of the hammer head.

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The horseless carriage race arranged to take place between Paris and Marseilles in July has been postponed to October, when it will take place under the direction of the Automobile Club, of Paris.

Cost of Calcium Carbide and Acetylene Gas.

A committee under the auspices of "The Progressive Age" has investigated the manufacture of calcium carbide at Spray, N. C., apparently getting at the real bottom facts in the case. As the Spray works are essentially an experimental plant, the highest commercial capability is not realized. The cost of the water power at the turbine is $5 per horse-power per year, and the total power used is 246 horse-power, costing $1,230 per year. The estimated cost of the plant is $1,200, and the labor cost is $11 per day. Running continuously 24 hours per day, the product is 2,000 pounds of carbide. The cost for materials daily is $14.39, and the ultimate cost of the carbide, with the plant running 365 days a year and 24 hours per day, is $32.77 per ton of 2,000 pounds. While the cost of the water power is low, the freight charges are heavy; but the operation of the plant as a whole seems to give us a tolerably reliable idea of the cost of production.

As one pound of carbide will yield approximately 5 cubic feet of acetylene gas, the cost of the gas will be $3.28 per 1,000 cubic feet. It will be really a little more than this, as the cost of conversion, storage, etc., has to be taken into account, so that it appears to us at present that $4 per 1,000 cubic feet is about the correct figure from which to compute the relative value of acetylene gas in comparison with other sources of heat, light and power.

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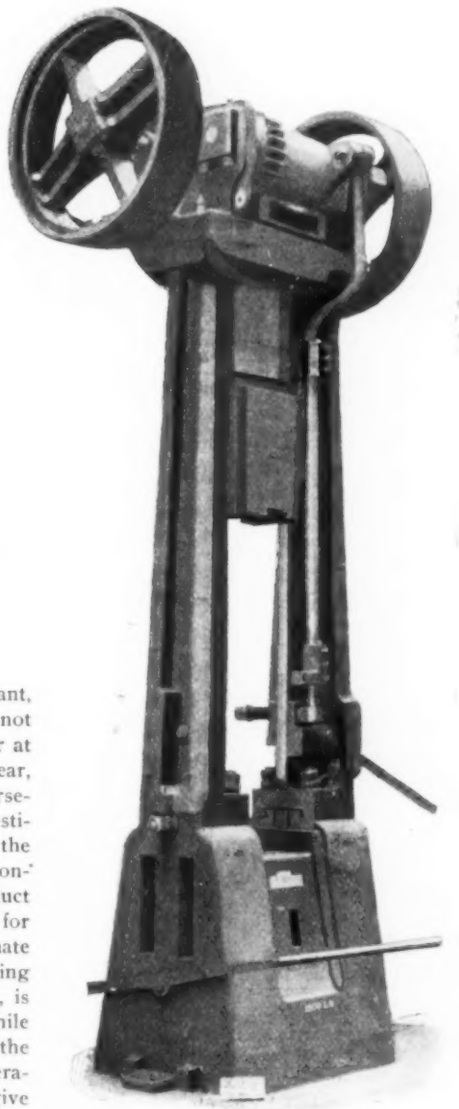
The British battleship "Renown" had her gun trial recently. The principal feature of the trials was the firing of the two 10-inch guns in each barbette simultaneously, at 35 degrees elevation right ahead and right astern over the deck. The trial was quite satisfactory and without incident. This ship has electric motors fitted to the elevating gear of all her 10-inch guns, and also to the ammunition hoists.



IMPROVED DROP HAMMER

The Uses and Advantages of a Public Supply of Compressed Air.

BY FRANK RICHARDS.

Pumping or Raising Water.

With our supply of compressed air standing always ready at a pressure of 100 pounds, another important general use of it would be for pumping or forcing water. Of the amount of power constantly required for this purpose it is useless to speak, and it would be also useless to attempt to give any reliable data concerning it. Every city, of course, has its water works, and water is practically everywhere. It seldom happens, however, that the water is delivered to us at a high enough level for our purposes. The drawing of water, one of the most primitive and unfailing of occupations, is still a necessity upon us. The draught upon the water supply of every city reduces the head during the busy hours, so that those who get what they want, and when and where they want it, from the unaided water-works system, are the exception rather than the rule.

For quantity and quality of water, New York has much cause for satisfaction in comparison with some of her neighbors, but in a large part of the city the supply may be said to be merely brought to the building, and not distributed through it, by the water works. Power pumps are in use everywhere for forcing the water to the upper stories. Steam pumps are largely employed, and also the hot-air pump is very frequently found, especially in the smaller and cheaper buildings. A very common advertisement in the daily papers is for the position of janitor or janitress. These janitors seeking positions are generally looking to have charge of the five-story and basement tenement houses which are so numerous, and which are so rapidly superseding every other style of dwelling, except for the wealthy. A common item of the standard advertisement of this class is the information that the applicant "knows all about pumps." This is so specified because the use of the pumps is so common. While the use of power pumps is so general in the "flat" houses, it is absolutely universal in the tall office buildings of every city. The three indispensable things in the equipment of every large building in these days are the elevator, the electric light dynamo and the power pump.

As compressed air is applicable for the development of power wherever steam is used, and as where a supply of it is provided, it is always a ready substitute for steam, it can always be used in a steam pump instead of steam. In the common direct-acting steam pump, however, the air should not be used if anyone has any desire of using the air with economy. That the air can be employed to operate the common steam pump has not added to its credit for economical employment. The large and unavoidable clearances to be uselessly filled in this style of pump, and the fact that at the end of the stroke the cylinder must be filled with air at its highest pressure, whether that pressure be needed for the work or not, make it extravagant and unnecessarily costly to use the air in this way. A pump designed to be driven by compressed air may be so made that the air will be enabled to make an excellent economical exhibit. In fact, there is no place where the economy of its application may be better adjusted and more clearly shown. The work of pumping water to a given level is so certain and uniform that a pump could be made exactly proportioned and adapted to the service; and the pump when done would also be a vastly more economical apparatus than the common steam pump of the day, even for steam.

With a constant air pressure of 100 pounds, and a known head or pressure of water to maintain, the areas of the cylinders should first be proportioned to the work to be done. The travel of the pistons should be limited at both ends of the stroke, preferably by a crank until a better device is invented, and a fly-wheel or other means of carrying the pistons to the ends of their stroke in either direction, and over the center, should be provided. Two sets of pistons connecting to cranks at right angles would greatly reduce the duty of the fly-wheel, and three pistons and cranks would do better still. A fixed cut-off should also be provided for the air cylinder, or cylinders, the cut-off occurring in this case at about one-quarter stroke, so that the terminal pressure would be nearly down to that of the atmosphere. The pump would, of course, be controlled by the throttle valve, and if a duplex pump, the throttle valve might be actuated automatically to vary the speed of the pump according to the fluctuations in the use of the water.

With our air supply provided and the cost of it known, we can compute approximately the cost of the air used for pumping a given quantity of water under selected conditions. Say that we have a building of considerable height, with a tank on the roof into which we are to deliver the water, and that the lift is 150 feet. As we will see later, this is not the ideal way of using an air supply for water service, but it seems proper to consider it in this connection. I assume that we have a duplex pump with the water cylinders 5-inch diameter by 12-inch stroke, and the air cylinders 7-inch diameter by 12-inch stroke, and that the pump is so designed and constructed as to satisfy the conditions which I have mentioned; that is, that the pistons shall have a positive travel and only the necessary clearance in the air cylinder, and that there will be a fixed cut-off at one-quarter stroke. Now, with 150 feet of total lift for the water, the pressure will be: $150 \times .434 = 65.1$ pounds per square inch. Allowing for pipe friction, we may make this 70 pounds; and with the pump running at 30 revolutions per minute, the power required for the water cylinders will then be:

$$5^2 \times .7854 \times 70 \times 120 \div 33{,}000 = 4.99 \text{ H. P.}$$

This we, of course, call 5 horse-power. The volume of water delivered per hour will be:

$$5^2 \times .7854 \times 120 \times 60 \div 144 = 981 \text{ cubic feet.}$$

We may deduct from this 5 per cent., which gives us 932 cubic feet, or $932 \times 7.48 = 6{,}971$ gallons per hour lifted 150 feet.

The theoretical M. E. P. of air at 100 pounds pressure, cut off at ¼ stroke, is 44 pounds. It is in practice higher than this, for two reasons: First, because the expansion of the air will not be absolutely adiabatic; and second, because when the clearance is included the actual rate of expansion will be materially reduced. We, however, can afford to neglect that, and the power of our air cylinders will then be:

$$7^2 \times .7854 \times 44 \times 120 \div 33{,}000 = 5.64 \text{ H. P.}$$

This, it will be noticed, is 12 per cent. in excess of the power required by the water cylinders. In connection with the conditions mentioned just above, the actual excess of power will be at least 20 per cent., and will be sufficient to cover all contingencies.

The volume of air used per hour will be:

$$7^2 \times .7854 \times 120 \times \tfrac{1}{4} \times 60 \div 144 = 481 \text{ cu. ft.}$$

To this we add ⅓, to cover all possible losses, which gives us: $481 + 161 = 642$ cubic feet. This, it will be remembered, is air at 100 pounds pressure; then, $642 \times 7.8 = 5{,}207.6$ cubic feet of free air per hour to lift 6,971 gallons of water 150 feet high in the same time. The time element, of course, has nothing to do with the air cost of the operation, as a larger pump would do it quicker, and a smaller pump more slowly, but either with presumably the same efficiency.

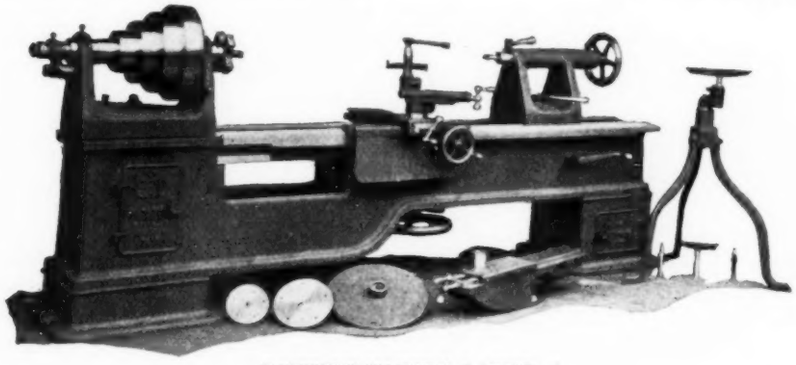
Dividing the cubic feet of free air used by the gallons of water lifted, $5{,}207.6 \div 6{,}971 = .747$, we find that it takes, say, .75 cubic foot of free air for each gallon lifted, or 750 cubic feet per thousand gallons; and as our air costs $0.05 per thousand cubic feet, of $0.00005 per foot, the cost will be $750 \times \$0.00005 = \$0.0375$—three and three-quarter cents per thousand gallons.

For lesser or greater lifts the cost will be in proportion; but in all cases the size of the pump and the ratio of its cylinders should be carefully adapted to the work to be done.

The use of the air for any such service as this affords an excellent opportunity for reheating the air before using. This invariably results in a considerable saving in the cost of the air used; and in the above case it would, with a saving of 25 per cent., bring the cost down from three and three-quarters to below three cents per thousand gallons of water lifted 150 feet. A saving of 50 per cent. is quite com-

monly claimed for reheating compressed air; but in all the figures given in these papers I prefer to keep well within the margin.

Where the quantity of water to be raised is not large, and where it can be done, say, once or twice a day, and someone can be at hand to start it, a single pump will do as well as a duplex, and it may always be arranged to stop automatically, so that no overflow will be possible. The advantage of the duplex pump is that it may be made entirely automatic, both for stopping and starting, and may be trusted to maintain the required supply night and day without attendance. Of course, it should not be necessary to keep reminding people that here, as elsewhere, if the air is obtained from the mains of the General Compressed Air Company, there are no boiler or boiler room, or coal or ashes, or water or fire, or fireman or insurance risk, or frequent repairs, or anything but occasionally paying the air bill.



PATTERN-MAKER'S LATHE.

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A New Pattern-Maker's Lathe.

We illustrate an interesting lathe especially designed for pattern-makers' use. The striking features of it are in the range of sizes of work provided for, and in the wide applicability of the slide rest. There can be no question that the providing of a good slide rest for a pattern-maker's lathe tends to the production of better work and the more rapid execution of it.

The lathe, it will be seen, is a gap lathe, the gap of which may be furnished of any desired width, the substantial top slide for the rest being moved back and forth by rack and pinion to open or close the gap, and then securely clamped as desired. The spindle is of hammered steel with large bearings. A face plate is provided for the back end, so that with the tripod rest, pieces may be turned much larger than will swing in the gap. The balanced cone has five steps, and a brake is provided for quick stoppage. The head-stock may be swiveled for bevels or tapers, and the tail-stock may also be set over. The carriage has long bearings and is gibbed to the top slide. It is fed along by rack and pinion, with a screw and crank for cross-feed and a graduated compound for angular work. The gap carriage is gibbed fast to top slide, and also has screw for cross-feed. The rest shown inverted in the foreground is also used in the tripod stand for turning large work.

The dimensions of the lathe shown are: Swing, 27 inches; over the ways, 50 inches; over the floor, 87 inches; gap opens 24 inches. The steps of the cone are from 4¼ inches to 16¼ inches diameter for 3-inch belt. The tight and loose pulleys of the countershaft are 10 inches diameter, to run at 600 revolutions per minute. Weight, 4,000 pounds.

The lathe is built by the Fitchburg Machine Works, Fitchburg, Mass.

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External "Broaching."

We illustrate a machine recently built by John T. Burr & Son, Brooklyn, N. Y., and specially adapted for cutting the teeth upon the reinforcement in the center of bicycle handle bars.

The machine is normally a broaching machine, and was illustrated and described by us as such in our issue of November 21, 1895. Instead of pulling a broach through a hole of any shape, the machine, as here shown, pulls the bicycle handle bar through a die, cutting upon it 64 teeth at a single operation. In addition to this, a special chuck and a hollow screw allow the handle bar to pass entirely through the machine in the one direction. A solid single die has been used successfully for cutting the teeth, but it is proposed to use two or more dies spaced with collars to allow of flooding with oil and a free passage for the chips.

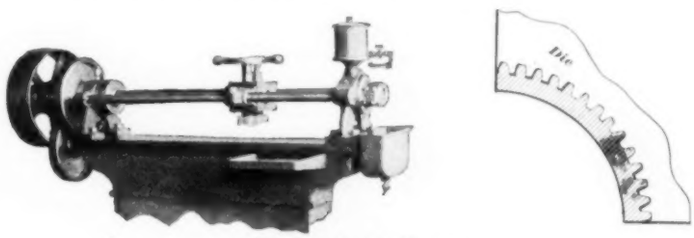
A BROKEN CRANK SHAFT.

▲ ▲ ▲

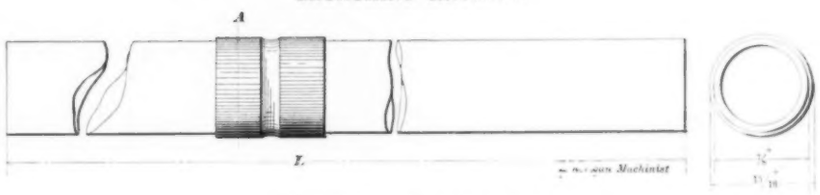
A Broken Crank Shaft.

The half-tone shows a broken crank shaft of a stationary engine of 250 horse-power. As will be seen, it broke in the journal near the crank. It was here 9½ inches diameter and 18 inches long in the bearing. The correspondent who sends us the photo tells us that the shaft was of hammered steel.

The engine was built in 1881, and it is probable that such a piece of material as this shaft is made of could not, or would not, be produced in any iron or steel works at the present day. The journal showed two pieces of metal which had been dovetailed into the shaft to fill holes in it, so that the manufacturers who forged the shaft were not alone culpable. We are told that eight new crank pins had been put into the crank of this same engine in ten years.



BROACHING MACHINE.



PORTION OF HANDLE BAR.

Fastening Piston Rods.

BY F. A. HALSEY.

While this subject is up for discussion, will someone please rise and explain the reason for the conventional taper fit between piston rod and crosshead hub in engines using keyed-in rods?

A good many engines have been built from my designs in which this fit was made straight, and if there is any objection to the arrangement it has not come to my knowledge.

I cannot see that the taper fit accomplishes any good purpose whatever, while it does accomplish the distinctly bad purpose of throwing a heavy and useless bursting strain on the crosshead hub. A taper fit is an expensive one to make, especially in this case, where the rod must be of a given length outside the crosshead boss—the matter being aggravated by the drawing of the rod into the hole by the draft of the key. Considerable cutting and trying is therefore necessary.

The straight rods are turned full size to the end without any shoulder whatever, and bottom on the bottom of the hole in the crosshead boss. They are made an easy sliding fit, which makes removal at any time a simple matter. The great advantage of the straight fit, however, is that it permits the rod to be boldly cut to length and finished at the first handling.

This avoidance of repeatedly putting together and taking apart, is one of the sources of shop economy which is not worked as it should be. It is carried to an extent in some shops which the old-time, cut-and-dry machinist would not believe possible, and there is no more fruitful field for a designer to study than to so lay out his work as to encourage it.

In the case of the fit in the piston, there is some excuse for the taper. At that end the rod cannot be made to bottom on its end. To forge on a collar is expensive, while to turn down for a shoulder of sufficient area reduces the area of the section of the rod. This area is still further reduced by the keyway or the threads for the nut, leaving a small net section, unless the rod is of excessive diameter to begin with; but if anyone can give any excuse for the taper fit, or any objection to the straight one, at the crosshead end, he will afford me information which I have searched for in vain.

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Pneumatic Transmission Tubes.

Editor American Machinist:

There has been considerable wondering of late why the pneumatic postal service, so successfully inaugurated a couple of years ago in Philadelphia, has not come to the front more conspicuously and been more generally adopted. There have been inquiries from several large cities as to why the Post-office Department has not given them this service, and a few weeks ago some newspapers took up the matter and argued for pneumatic transmission.

There has been no complaint of unsatisfactory performance in Philadelphia, while its forty miles of tubing have been steadily at work ever since they were planted, without a single break or cessation in the service.

This system can no longer be said to be on trial, and the delay on the part of the Government in extending it is noticeable as compared with Berlin and other European capitals, where it is in extensive and successful operation.

Here in New York, where the policy is to centralize the Post-office, making the suburban towns branch stations, with a view to a more economical service, the pneumatic tube system would prove especially valuable; in fact, it would tend more than anything else to make penny postage practical.

Within the boundaries of the Greater New York to be, nothing could better unify and cement the aggregate parts into one body than postal communication that would give all the advantages of the telegraph and the telephone. I believe the Government expended about $25,000 on the experiments in Philadelphia. If the service for the Greater New York were to cost a million, it would be money well expended.

I have been at some pains to investigate the present prospects of the pneumatic enterprise, and find that it is full of life and vitality. While not a great deal has been said of late on the subject, and the Government has done nothing, those financially interested are preparing for an extensive use of the tube for commercial purposes. Some experiments in this line have also been made in Philadelphia, with satisfactory results. The experiments with six to eight-inch tubes have been successful, and the system is being perfected for even larger service. It is believed that from one to two feet diameter are practicable, and that such service will be seen at no very distant day.

Some short-line experiments have been made with much larger tubes, even for passenger transportation, but the question of cost comes in to limit the size, the most practical engineers now confining their efforts in the main to parcel transportation. A New York company controlling the rights in the leading inventions for pneumatic work has obtained a concession from the Underground Rapid Transit Commission for an eighteen-inch tube space in the conduit, whenever that may be built, when a very general package service would be inaugurated.

All the difficulties of lateral branches have been overcome by patent switches, while electrical devices give notice of the destination and whereabouts of packages forwarded. It is not meant here, however, to go into details of the technique of the pneumatic system. The aim is to give the public assurance that it is not dead or declining. On the contrary, it is destined to perform great service to the public and to become an indispensable adjunct to all retail business.

The special advantages of pneumatic service are speed, economy, efficiency and privacy. Letters and sealed dispatches can be delivered more quickly than telegraphic messages, while there is, of course, no limit to words, and entire privacy is secured and it is more economical. All these advantages have been fully proven. In Philadelphia, packages have been sent at the rate of fifty-eight per minute, which illustrates the speed and commercial value of the system.

Whatever delays there may be in any of the proposed private enterprises for commercial uses, there ought to be none on the part of the Post-office Department in extending the system to the distribution of the mails from the central offices to the sub-stations. Nothing could probably be done in any direction that would so greatly facilitate business in the large cities as the use of pneumatic tubes for the postal service. Will not the department wake up to the importance of this matter and let the good work go on?

MAX JAGERHUBER.
680 West End Avenue, New York.

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Bicycle Tools—XXIII.

HUBS—CONTINUED.

There is possibly still a difference of opinion as to what is the cheapest method of making a cycle hub of the ordinary flanged form. Those who should by varied experience be best qualified to speak with certainty, say that there is but little difference in the cost of the various methods when carried out under superintendence of equal efficiency. There may be, and unquestionably there is, a very considerable difference in the cost of hubs in different shops. Some shops believe a drop-forged blank makes a far better hub than can be shaped from the solid bar, and it is a common saying among experts that a finished cycle hub can be made from the solid bar at a stock-included cost no greater than the cost of a rough drop-forging for the same hub. If this is true—and I do not think it is very far out of the way—then if this drop-forged blank is finished by twenty-one separate engine lathe operations, as is the Gormully & Jeffery practice, the G. & J. hub must cost a good deal more when it is machined than the Lozier hub costs in the same condition. My last conversation with Mr. Jeffery in regard to hub-making took place nearly three months ago. At that time the G. & J. hubs were finished in the lathe; but the solid bar and screw machine method was being tried carefully. What the result of this trial was, or what changes have been made in the G. & J. methods since last January, I do not know. The operations were made so numerous as to obtain all advantages possible from

minute sub-division of work, and all the arbors, drivers and lathe tools generally were made in multiple, so that each lathe and lathesman had a simple cut to make and excellent facilities for expediting the operation. It would be a waste of time

Fig. 148. STIRLING HUB PARTS.

to specify and separately describe each one of the G. & J. twenty-one hub making operations. The hubs are made in common engine lathes, and when finished are fine examples of the turner's art, and are as near an approach to perfect truth as any commercial machine work is expected to be. It is this truth and uniform concentricity of the lathe-finished hub which makes this expensive method of finishing possibly economical. Hubs made in the lathe are true, very nearly; while hubs made in the screw machine can never be relied upon as true, and must be, and are, refinished where accuracy is demanded.

Besides the hubs made from the solid bar or from drop-forged blanks, there are several hub forms which have a body of drawn tube and flanges of different

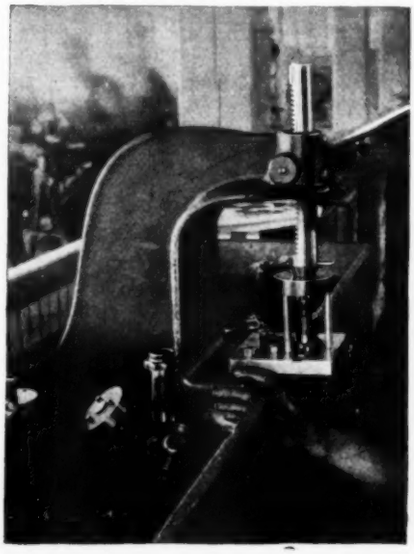

Fig. 149. ASSEMBLING STIRLING HUBS.

sheet metal, "struck up" or "drawn" shapes.

The Western wheel hubs are made of a heavy tube with drawn flanges brazed on. Formerly these hubs and flanges were made from stock of such gage that the press operations brought the parts to finished dimensions. Now the blanks are much thicker than the finished parts; the inside diameters are made right in the brazed blank, and the pieced-up structure is finished all over outside in the engine lathe, as shown in Fig. 148. It was found difficult to produce uniform hubs by press work alone. By using the present thick sheet-metal stock, the Western wheel obtains a cheap blank having a minimum finish, while the metal is of the best quality. This method of hub-making has the unqualified approbation of the Western wheel management.

The Stirling cycle-hub parts are shown in various stages of progress, including the finished hub, in Fig. 148. The tube 9, Fig. 148, has brazed on it two wave-flanged collars 8, and its finished form is shown at 10. The Stirling spoke is straight, and the cup-flanged collars are formed in waves or scallops, so that each spoke-head finds a flat seat at right angles to the line

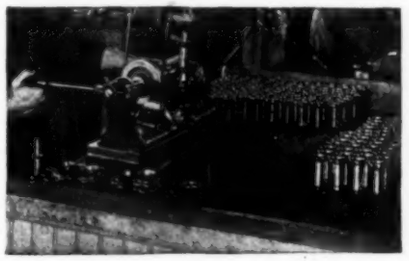

Fig. 150. DRILLING STIRLING HUBS.

of spoke tension. The spoke flanges are made of such size that the spokes can be slipped to place past the barrel from the inside. This makes a very light and strong hub, with many points of excellence, and is controlled and used exclusively by the Stirling Company. The scalloped flange is drawn up from the flat blank 1, Fig. 148, by eight operations, during which it assumes the successive forms shown in the engraving, which will be perfectly understood by die-makers.

The operation of assembling the Stirling hub is shown in Fig. 149. The tool is a rack-and-pinion hand-press, with a disk on the lower end of the ram which stops on three gage studs, two of which appear in the picture. It will be observed that this method of gaging the hub length eliminates all possibilities of error, as the gaging is absolute from one end to the other end of the hub.

Drilling the cycle-hub spoke holes is an operation which affords opportunity for the exercise of ingenuity, and this operation is performed in some shops by a single-spindle drill, which takes all of a hand's time to operate it; in others by banks of single-spindle automatic drillers, and in yet other shops by multi-spindle drillers—sometimes half as many drill spindles as there are holes in the hub flange, so that all the holes in one flange are drilled at two operations, the hub being indexed around—the centre-to-centre distance of two adjacent spoke holes—between the first and second operations.

In the case of the Stirling hub, where the spoke holes are drilled at right angles to the plane of the hub axis, the driller is a single-spindle special machine, shown in Fig. 150. The operator feeds the traversing drill spindle with his right hand, and indexes the vertical hub arbor with his left hand. The holes are very short, only through the thin sheet metal of the flange; hence, the drill speed can be very high and the operation proceeds rapidly.

The very simplest form of spoke-hole drilling machine which has come to my notice is that shown in Fig. 152, from the Stover cycle shops, Freeport, Ill. This driller was photographed in June, 1895, and may not be in use at this time, as the Stover factory was then in its early days. The driller itself was a very simple vertical affair, bolted to a post. The fixture is of the simplest possible design—a cast-iron base, in one piece with the upright, to which the jig holder is bolted at upper end; the index pin is a spring plunger seated in the thickness of the lower part of the upright fixture member, and the whole rig is a very low-cost construction, and at the same time is as effective as a single-spindle driller. The indexing was done with one hand, although it does not look as if that was easy to do, and the drilling was quickly accomplished.

The Pratt & Whitney multiple-spindle

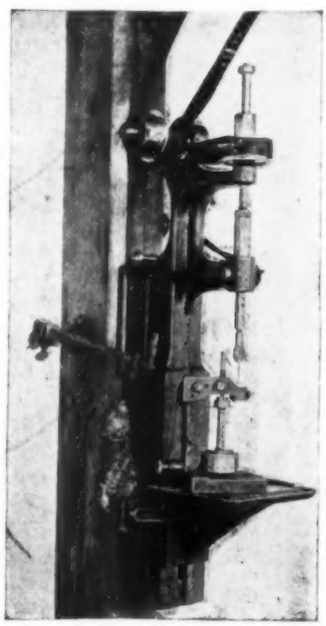

Fig. 152. HUB-DRILLING MACHINE.

hub driller, which has been illustrated in these columns, is very largely used. In this machine the drill spindles are driven through universal joints; both spindles and joints are as small as is safe to make them, so as to bring the spindles close together, and the machine is quite elaborate. In various forms this universal joint driller is largely used in manufacturing operations of all descriptions,

heavy and light, and used with great satisfaction. As examples of this Pratt & Whitney hub-drilling machine appear in almost every cycle shop, it need not be described in detail here.

HUGH DOLNAR.

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Some Dividing Tools.

BY A. H. CLEAVES.

It frequently happens in shops where a variety of work is done that a graduated scale of some kind is called for, and where but one or two pieces are to be made it is not desirable to make very extensive preparations for the work.

The accompanying cuts illustrate several methods of doing different kinds of dividing work. In Figs. 1 and 2, suppose it is required to make a scale on the piece *c*, the divisions to be .05 apart, and the lines at quarter and half inches lengthened. There might be no milling machine in the shop with graduating devices, or if there was it might be more convenient to do the work in an engine lathe, and so a method of doing the work in this way is presented:

An engine lathe without a tail-stock face plate like *A*, Fig. 1, should be furnished with one to start with—at least one such lathe in a shop should be so furnished. In many cases one of these makes a fair substitute for a drill press and is especially useful in connection with counterbores. In the present case the angle plate *B* is secured to the face plate mentioned as shown, Fig. 1, and the strip or bar *c* to be graduated clamped to the angle plate in any convenient way. A piece of square steel or brass can be used to hold the marking point *E*. *E* is the nicely ground or filed point of a fine-threaded screw, and should fit the bar *D* tightly to avoid the chance of moving while in use and changing the depth of lines.

The best and quickest way to level the piece *c* in relation to the point *E*, both lengthwise and crosswise, is to gage the same by the point itself. Level up crosswise by revolving the plate *A*, and lengthwise by putting paper under either end as necessary. The best way to sense the contact of the point *E* at all parts of the surface of *C* is not by sight, but by sliding a thin piece of steel, like one of Starrett's flexible scales, for example, between the point *E* and the surface of *C*.

Having the lathe geared up to cut a twenty thread, start the same by hand to take up any lost motion, or turn the lathe handle backwards. Then secure any device similar to the one shown in Fig. 3, and use it for a stop at each turn of the lathe by hand.

A is the regular head-stock face plate, *B* a Besley clamp fastened to the same, *C* is a stud or post put in the bar *D* which rests on the latheways loosely. When *A* is to move a turn, *C* is taken away and then returned to stop *B* in the same place each time. The point *E* is then set at the starting line, and the depth of line determined by the screw being turned down as required. Slips placed between the cross-slide on the lathe and a clamp or piece clamped to the carriage, determine the length of each line—a short slip being used for the long lines, and a long one for the short ones.

If a large number of pieces is to be divided, and they are of uniform thickness, so as to be easily located accurately, then a tool illustrated in Fig. 4 can be used, with which an inch or any desired distance within that limit can be covered at once, the marking points being grouped, as shown, in one tool. The grooves are milled in a machine with a dividing index on the feed screws. The different points are then milled off for eighths, quarters, etc., as shown at *ccccccc*, Fig. 4 A. In this way one inch of lines, or whatever it may be, is marked at once. Of course it will not pay to make this tool unless considerable graduating is to be done, because it must be carefully made to prevent showing variations in the spaces at the ends of the groups of lines.

In Fig. 5 another feature in this line of work is illustrated. The holder *A* used in the lathe tool post carries the bar or arm *B*, which holds the marking point *C*. The arm *B* swivels at *D*. This sketch illustrates two methods at once for making lines on surfaces not level nor even. In one case the weights or weight *E*, as it may be, give a uniform pressure on the work at *c*, whether flat or uneven; in using which the spring *F* is not required. This spring *F* is a substitute for the weight *E*, and its force can be adjusted with the screw *G*. The same effect is secured at *E* by using several weights.

In Fig. 6 a still different and very practical plan is shown. If a brass tube *A* of two or three feet in length was provided with a long opening *B*, it would be found generally sprung out of round; and if it were desired to graduate or mark a scale along the edge of this slot, it would be found quite difficult to get the work true, and get rid of the spring sufficiently to make the lines in any arbitrary way. By using a tool like *C* with an adjustable point for cutting the lines like *D*, then the work *A* at each turn of the lathe to the stopping place can be brought by the hand against the point of *D*, the depth of the cut being gaged by the end of *c* coming against the tube *A*. The tool *C* is drawn back after each cut, and then returned to position by using the stop screw employed in thread-cutting. The length of the lines can be gaged by stops of any kind fastened to the face plate of the lathe and acting on a lathe dog on the tube *A*.

The point *c* in Fig. 5 is adjusted the same as that in Fig. 2; and the same principle for advancing the spaces is used in all, as shown for Figs. 1 and 2.

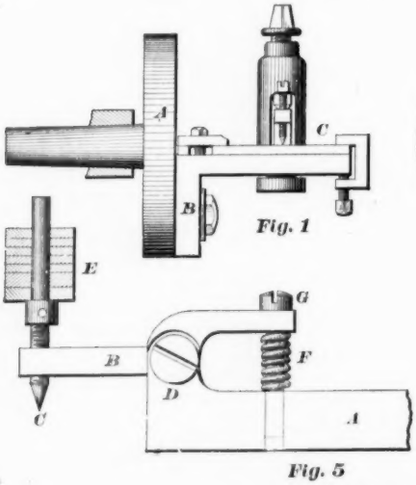

Fig. 1

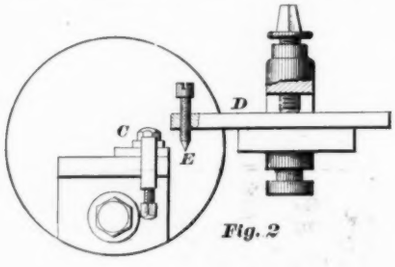

Fig. 2

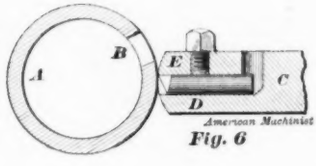

Fig. 6

Fig. 5

DIVIDING TOOLS.

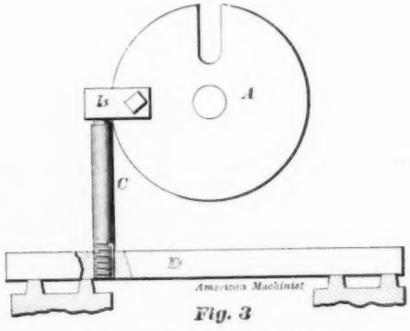

Fig. 3

STOP FOR GRADUATING.

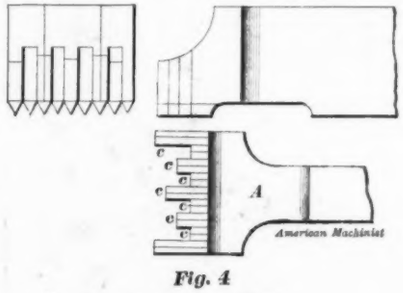

Fig. 4

A GANG MARKER.

ELECTRICAL MACHINERY.

A Series-Motor Controller and Reversing Switch.

The extent to which the improvement in electrical machinery of all kinds has been due to the introduction of better mechanical features, is only appreciated by those who have followed the development in detail. The scope for mechanical ideas of design in electrical apparatus is well shown in the accompanying illustrations of a series-motor controller, designed by a mechanical engineer because of the unsatisfactory character for his purposes of the controllers to be had in the open market. The controller is the production of the Morgan Engineering Co., of Alliance, O., and was designed with particular reference to the requirements of their traveling cranes. The main points aimed at in the design were the following:

Coils of such shape as to permit machine winding.

A disposition of the coils which should be compact and at the same time open to free circulation of air, and especially uniform circulation which should not favor some coils at the expense of others.

A minimum of machine work, especially on the contact points, in order to reduce the expense of renewals.

Facility in making renewals of the contact points with as little labor and loss of time as possible.

Absence of interior cable connections.

Increased number of contact points with finer graduations than usual.

Operation of controller and reversing switches by the same lever.

Action similar to that of an engine reverse lever, various positions of the operating lever acting to control the motor in the same way as a link-motion lever.

How well these points have been met, the illustrations will show.

The general appearance of the controller is well shown in Figs. 1 and 2, which are front and rear views, respectively. The case or frame of the controller consists of a circular skeleton frame-box casting. The coils are flat, like close-coiled watch springs, and are arranged within the case in planes which radiate from the center of the case, as shown in Figs. 3 and 4, the former being an elevation and the latter from a photograph with the side of the case removed. These coils are machine-wound on skeleton spools, as shown in Fig. 5, the insulation being wound in at the same operation. Each coil makes electrical connection with the hub of its spool at *a*, Fig. 5, but is otherwise insulated from it. At the outer end, each coil has a cross-strip connecting it to one of the arms of the next spool at

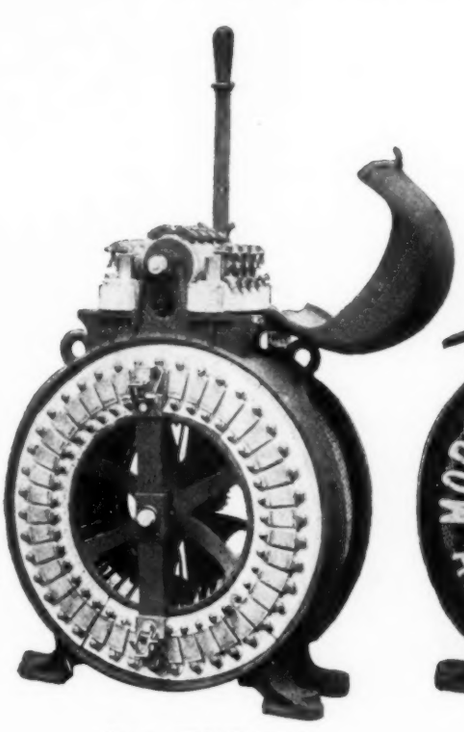

Fig. 1. FRONT VIEW.

Fig. 2. REAR VIEW.

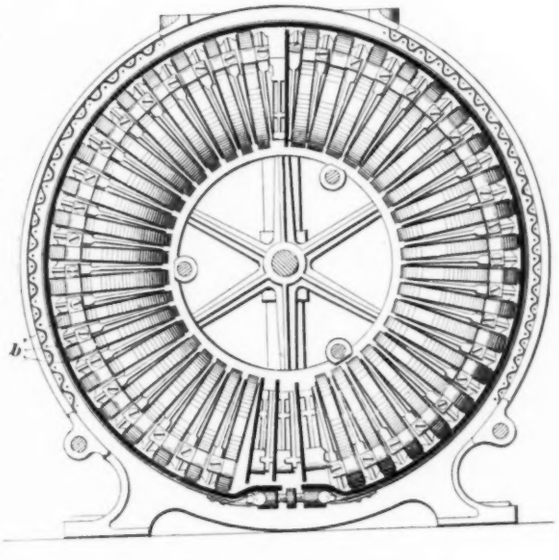

Fig. 3. ARRANGEMENT OF COILS.

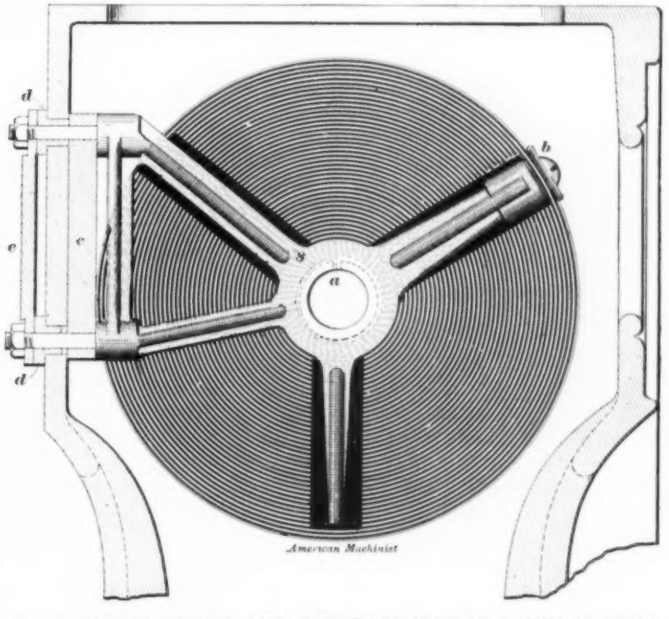

Fig. 5. WINDING OF COIL AND CONNECTION WITH CONTACT PIECE.

b, Figs. 3 and 5. This connection carries the current from the outer end of one coil, through the next spool to the inner end of the next coil, through which it then circulates to its outer end, where it is carried by the next connecting piece *b* to the next spool, and so on. The skeleton spools also make electrical connection with the contact pieces, shown in a circle in Fig. 1. The current thus circulates in succession through the coils up to the one whose contact piece has the cross-bar controller switch, shown in Fig. 1, resting upon it. The connection of the spools with the outside contact pieces is shown in Fig. 5.

Two of the spool arms reach toward the face of the case, and are connected together by a strengthening tie. The foot of each of these arms has a hub into which a stud is cast, which serves to secure the spool to the case, and also to make the connection with the contact pieces outside the case. Between each pair of hubs and the iron case is placed a porcelain strip *c*, through which the studs pass. A porcelain bush *d* is put over each stud outside the case, after which the contact piece *e* is slipped on and secured by nuts. The insulation at this point will be seen to be very cheap, and at the same time absolute. Cable connections between the coils are entirely dispensed with, and the contact pieces can be renewed by simply taking off the nuts, removing the old contacts and substituting new ones. The contacts are simple iron castings, without machine work of any kind.

The controller switch is a cross-arm, shown in Fig. 1, properly secured to a shaft extending through the frame box. At the end of the shaft opposite to the switch arm is keyed a pinion, which is operated by the operating hand lever in the manner clearly shown in Figs. 2 and 4.

The reversing switch is composed of an insulating drum of porcelain, with contact points projecting from it, and is mounted on the top of the controlling switch case, as shown in Figs. 1, 2 and 4. This drum is operated by a pin projecting from the hand lever, which enters a fork secured to the drum shaft. The contact pieces on the drum are removable by loosening nuts sunk below their faces, and the stationary contacts shown each side of the drum are held in place by spring latches, making renewal but a matter of a moment's time. Substantially the same construction is followed with the contact pieces on the ends of the controller-switch arm—the contact pieces for both switches being simple brass castings, without machine work of any kind beyond the grinding-off of the fins left in the castings.

The open periphery of the case is covered over by a wire-cloth net. When used in rolling mills, or similar places, where the iron dust and scales penetrate everything, the net is replaced by sheet iron, and the open spaces in the frame box are also covered with sheet iron. A hinged cover, shown open in Fig. 1 and closed in Figs. 2 and 4, is provided for the protection of the reversing switch.

The operation of the controller will be apparent from the illustrations. In the position of the hand lever, shown in Figs. 1 and 2, the circuit is broken and the motor is stationary. If the lever be thrown forward, the circuit is completed through the upper switch, and through the entire set of resistance coils. As the motor speeds up, the lever is moved further ahead, and the controller switch moves over the circular contact points, cutting out the coils in succession, two at a time,

Fig. 2. REAR VIEW WITH BACK REMOVED.

by the short circuit through the switch arm. When the lever is clear over, the coils are all cut out, and the motor has full current. If the lever be drawn backward the action is the same, except that the connections of the reversing switch are such that the current through the motor is reversed and the motor turns in the opposite direction.

As a result of this design, Mr. Morgan informs us that, while providing for ample ventilation, he has succeeded in getting three times the amount of resistance ribbon in the same bulk as other controllers, and that, compared with a controller supplied by one of the electrical companies, he has saved four hundred screws, while there are no cable or wire connections in the machine, except those connecting the reversing switch with the terminals of the resistance coils.

As has been said, the controller was designed for use with cranes, and without any idea of sales for other purposes; but we are informed that it has made quite a market for itself, one of the electric motor companies having adopted it for regular use.

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Torque and Counter-Torque, Electromotive Force and Counter-Electromotive Force.

A belt driving a dynamo exerts a certain pull on the edge of the pulley which tends to turn it, or produces a torque, as it has come to be called. The product of this pull by the velocity of the belt per second or minute is the power put into the dynamo.

The generation of current consumes work and offers resistance to the turning of the armature—that is, it exerts a counter-torque, which is equal to the applied torque less the torque required to turn the machine itself. If an engine connected to one end of a shaft drive an air compressor connected to the other end, the engine exerts a torque which turns the shaft, and the air compressor exerts a counter-torque which resists the turning. The counter-torque is equal to the applied torque less the losses of transmission, and the counter-torque divided by the applied torque gives the efficiency of the machine. Just so with the armature of a dynamo—the counter-torque divided by the applied torque gives its efficiency. An explanation of counter-torque is useful, because it furnishes the readiest means of explaining that great mystery to many —the counter-electromotive force of an electric motor.

Any effort to do work meets with resistance, and the doing of work is in fact the overcoming of resistance. In a dynamo three forces are at work—the applied torque, which represents the effort to drive the machine; the electromotive force, which produces current and represents the result of the machine action; and the counter-torque, which represents the resistance due to the work done. In an electric motor there are also three forces at work—the applied electromotive force, which represents the effort to drive the machine; the torque, which produces motion and represents the result of the machine's action; and the counter electromotive force, which represents the resistance due to the work done. In the generator, two of the forces are mechanical and one electrical. In the motor, two are electrical and one mechanical.

Imagine an engine driving a machine through a train of belts and pulleys. The power given by the engine to the first belt is the product of the pull on that belt by its belt velocity. The power given out by the last belt to the machine is likewise the product of the pull on it by its velocity. The second product is less than the first

by the losses of the transmission. Divide one by the other and we have:

$$\frac{\text{Power delivered by last belt}}{\text{power absorbed from engine}} = \frac{\text{pull on last belt} \times \text{speed of last belt}}{\text{pull on first belt} \times \text{speed of first belt.}}$$

The power given up by a current in driving an armature is analogous to the power given by the engine to the first belt, and the power delivered by the armature is analogous to that delivered by the last belt—the second amount being smaller than the first by the losses of the transmission. The power given up by the current is equal to the product of its volts of electromotive force by the amperes of current, and the power delivered by the armature is the product of the volts of counter-electromotive force by the amperes, precisely as the power delivered by the last belt is equal to the pull on it (that is, the resistance of the machine to turning) multiplied by its velocity.

Dividing the power delivered by the power absorbed from the current, we have:

$$\frac{\text{Power delivered by armature}}{\text{power absorbed from current}} = \frac{\text{counter E. M. F.} \times \text{amperes}}{\text{applied E. M. F.} \times \text{amperes.}}$$

Going back to the mechanical transmission, imagine the proportion of the pulleys to be such that the speeds of the first and last belts are the same. Having the same speed in both numerator and denominator, it may be canceled out, giving:

$$\frac{\text{Power delivered by last belt}}{\text{power absorbed from engine}} = \frac{\text{pull on last belt}}{\text{pull on first belt.}}$$

Now, with an electric motor the amperes of our equation are those of the current through the armature, and are, of course, the same in both numerator and denominator. They, like the belt speeds, may then be canceled out, giving:

$$\frac{\text{Power delivered by armature}}{\text{power absorbed from current}} = \frac{\text{counter E. M. F.}}{\text{applied E. M. F.}}$$

The $\frac{\text{power delivered at last belt}}{\text{power absorbed from engine}}$ is, of course, the efficiency of the transmission, and in the same way the $\frac{\text{power delivered by armature}}{\text{power absorbed from current}}$ is the efficiency of the transmission, which, we have seen, is the ratio of the counter E. M. F. divided by the applied E. M. F. This is an important law of electric motors. It should be distinctly noted here that the absorbed power referred to is that supplied to the armature, and the power delivered is also by the armature. The resulting ratio is the efficiency of the armature. In point of fact, power is also consumed in the field coils and in the bearings of the armature shaft, so that the efficiency of the whole machine, between the current supplied to the terminals and the power delivered by the belt pulley, would be less than that above considered.

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Power Required for Driving a Pipe-Threading Machine, a Boring Bar and a Roll-Turning Lathe.

BY J. S. COX.

Following is a record of some tests made by me on pipe-threading machines, to ascertain the power required to cut and thread various sizes of pipes:

Motor used: Crocker-Wheeler, shunt-wound, 3 horse-power motor; speed, 950; belted to countershaft, and countershaft cone pulleys belted to pulleys on machine.

Meters used: Weston voltmeter, Whitney ammeter, and afterward Weston ammeter.

Motor on 3-inch threading machine.

Threading machine running free, 7 amperes, 125 volts, or 1.2 electrical horse-power.

No. of Test.	Size of Pipe.	Nature of Work.	R. P. M. of Machine.	Lineal Feet Cut per Min.	A.	V.	Elec. H. P
1	1½	Cutting	40	20	18	85	2.0
2	1½	Threading	45	22.4	16	95	2.0
3	1½	Threading	45	22.4	20	85	2.3
4	2	Cutting	32	20	20	115	3.1
5	2	Cutting	32	20	17	105	2.4
6	2	Cutting	32	20	16	105	2.2
7	2	Threading	32	20	20	85	2.3
8	2	Threading	32	20	23	105	3.2
9	2	Threading	32	20	24	105	3.4
10	3	Cutting	32	29.3	30	105	4.2
11	3	Cutting	32	29.3	25	100	3.3
12	3	Cutting	21	19	19	105	2.7
13	3	Threading	32	29.3	35	100	4.7
14	3	Threading	32	29.3	38	95	4.8
15	3	Threading	21	19	22	105	3.1

In the above table the speed in Nos. 10, 11, 13 and 14, which gave a lineal cut of 29.3 feet per minute on 3-inch pipe, was too great and burnt the dies. In the other tests on 3-inch pipe a cut of 19 lineal feet per minute was taken. This is about the correct speed. The dies used in the above cases were new. The table gives the maximum amperes of current required at any time during the work, the meter showing this amount for one or two seconds at the end of the cut.

The following table shows the average and maximum work:

No. of Test.	Size of Pipe.	Nature of Work.	R. P. M. of Machine.	Lineal Feet Cut per Min.	Amperes.		Volts.		Elec. H. P.	
					Aver.	Max.	Aver.	Max.	Aver.	Max.
16	1½	Threading	45	22 4	16	18	115	115	2.5	2.8
17	3	Cutting	21	19	14	19	105	105	2.0	2.7
18	3	Threading	21	19	16	21	110	105	2.3	2.9
19	3	Threading	21	19	18	22	112	108	2.7	3.2

The following table shows the results of tests on an 8-inch threading machine:

Motor used: 3 horse-power, Crocker-Wheeler, shunt-wound motor; 950 revolutions per minute.

Threading machine running free, 12 revolutions per minute; 125 volts, 9 amperes, 1.5 electrical horse-power.

Table shows maximum amperes of current.

No. of Test.	Size of Pipe.	Nature of Work.	R. P. M. of Machine.	Lineal Feet Cut per Min.	A.	V.	Elec. H. P.
20	4	Cutting	12	14	18	118	2.8
21	4	Cutting	12	14	18½	118	2.9
22	4	Cutting	8	9.4	16	115	2.5
23	4	Threading	12	14	....	115	...
24	4	Threading	12	14	....	115	...
25	5⅝	Cutting	8	12.5	16	123	2.6
26	5⅝	Cutting	12	18.8	16¾	118	2.6
27	5⅝	Threading	12	18.8	22	118	3.5
28	5⅝	Threading	12	18.8	22	113	3.3

In Tests Nos. 23 and 24, the amperes ran up beyond 25 (the capacity of the meter). I estimated the maximum to be about 35 amperes, 115 volts, or 5.3 electrical horse-power.

The 5⅝-inch pipe in Tests Nos. 25, 26, 27 and 28 is "casing" pipe, and the thread being finer, the work is not so great as in 4-inch ordinary pipe.

BORING BAR.

The following is a test as reported to the writer:

Motor used: 10 horse-power Crocker-Wheeler, with countershaft in base belted to a boring bar.

Cylinder, 84 inches diameter; ⅜ cut with four diamond-point tools, ⅛-inch feed. Power required, 8 horse-power.

ROLL-TURNING LATHE.

The following, on a roll-turning lathe, is also reported to the writer, who has confidence in its accuracy:

Five horse-power Crocker-Wheeler, shunt-wound motor. Speed, 1,000 revolutions per minute.

Size of roll in lathe, 28 inches diameter at cut.

Revolutions of roll, 1 revolution in 1 minute 14 seconds.

One cut reduced roll $\frac{3}{64}$ inch diameter.

Width of tool, 5¼ inches.

Motor running lathe, no cut, 220 volts, 1.5 electrical horse-power.

Motor running lathe, full cut, 20 amperes, 225 volts, 4.4 to 5.9 electrical horse-power.

Temperature of motor after ten hours was normal.

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The Immigration Restriction League, whose headquarters are at 732 Exchange Building, Boston, has issued a circular in which it states that from January 1 to March 31, 1896, 13,946 Italian immigrants arrived in this country, and that 7,001, 50.2 per cent., of these were illiterate. The league advocates an educational test for admission to this country, claiming that immigrants admitted here should be sufficiently ambitious and intelligent to at least be able to read and write some language.

Letters from Practical Men.

Milling Bicycle Hubs.

Editor American Machinist:

Referring to Article No. XXII. on "Bicycle Tools," and to the final paragraph of the same referring to Columbia hub tools, would say the practice indicated of drilling, reaming and then circular milling outside with form cutters was used by us towards the end of '94, and we put down six machines for this purpose. The process, however, was so slow, notwithstanding the high cutter speed we used, and the almost nominal cost of the operation, that we abandoned the same.

If any of your readers can give any statistics of successful hub milling it would be interesting, as probably circular milling is one of the most troublesome operations known.

We may say that we shall not ourselves again adopt this process for the purpose of machining hubs.

THE SHARK MFG. CO.

Croydon, Eng.

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A C amois Skin in Place of Chalk on Tracing Paper.

Editor American Machinist:

The discussion in your paper as to the relative value of powdered chalk and talc —or "agalite," as the paper-makers call it—to remove the gloss from tracing cloth, reminds me of the old story of the Irishman who, when asked whether the pronunciation of "either" was "eether" or "eyther," replied that it was "nayther;" it was "ayther."

I do not approve of using "ayther" powder, as no matter how carefully it is dusted off there still remains enough to clog the pen nibs when set closely, thereby causing irregular lines.

I was at one time a confirmed chalk-user, and it seemed incredible to me that a piece of chamois skin without powder of any description would remove the gloss as perfectly. I found, however, by experience that it would do so, and insure a much cleaner drawing, especially in fine work.

While not expecting to make many converts, I hope some of your chalk-using readers will try it, and rub hard.

GEO. A. FAIRBANKS.

Watertown, N. Y.

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To Determine the Rotation of a Bullet.

Editor American Machinist:

Will you or can some reader tell me how I may measure the rotation of an elongated bullet about its longitudinal axis after it leaves the barrel? Will the two methods given below measure and indicate the bullet's rotation?

1st. Take a patched bullet; under the patch drill a small hole (say $\frac{1}{16}$ inch) in the side; insert into this hole a tight-fitting plug of aniline violet (such as used in indelible pencils). Cut off the projecting plug by turning in a lathe. Place the bullet in position in the usual manner of patched bullets; use no gum of any sort to fasten the patch in any manner. Fire the bullet through twenty milk-white hectograph pads, taken out of their tins and placed 6 inches apart. Will the aniline mark a spiral path as it goes through the consecutive pads?

2d. Attach to the rear of the bullet two unspun silk threads—one white and one green—of same length and weight; carefully coil each thread separately, and place the coils carefully behind the bullet, between the bullet and a cork disk, in the usual cartridge. Now, if two cartridges be thus prepared, and one be fired from a smooth bore and the other from a rifle, into a sand-bag, will the threads of the latter be found twisted and the former not?

J. LANDSING.

New York.

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Fastening Piston Rods in Crossheads.

Editor American Machinist:

The question of holding piston rods in crossheads is an important one.

Both Mr. Bullock and Mr. Swift prefer the threaded rod, but one wants the rod split and the other wants the head split, to provide means to securely hold the two parts together. The less splitting or screwing there is around a crosshead the better; there are too many crossheads now that are enormously heavy without being strong, and easily adjusted, both vertically and horizontally, but not safe after they are adjusted.

On small engines the screwed rod will do very well and be convenient; but on large engines, running fast with heavy loads, it is out of place, and there have been three failures of screwed rods in this city, with serious results in each case.

The ideal method of connection is to make the rod and head of one piece, as is done in marine work, and the next best thing is a properly designed and fitted key and taper rod.

In a recent case of five engines from one of the leading builders, no two of the threaded rods were interchangeable, and we may reasonably doubt the fact that they will furnish rods and heads within an allowance that is necessary to have them interchangeable.

The method of putting in a crosshead pin by taper fits is all right, and holds its own in spite of the many different schemes that have been tried to avoid it. However, it is not very convenient to draw in a large pin, with a nut 9 or 10 inches diameter and a wrench 24 inches long, as is usually furnished. This can be avoided by tapping out each end of the pin for four or five bolts, and then by using a heavy recessed washer to fit the bolts, one man can draw in or out a large pin by putting the bolts on the different ends of the pin as required.

T. ELLIOTT,

Chief Eng. Consol. St. Ry. Co.

Atlanta, Ga.

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Some Cable Problems.

Editor American Machinist:

It has lately fallen to my lot to design a machine which uses a very long $\frac{7}{8}$-inch steel cable, and the power is applied to the cable by double-grooved drums which have several turns of the cable about them. The cable is not endless, but as hauled in is taken care of by a separate storing device and under very little strain. I have come across a bit of someone else's experience with double winding drums which was not satisfactory. The conditions were the same; that is, a heavy strain on cable where it winds upon the winding drums, and a light strain where it leaves them. The cable was found to have an excessive wear and a short life. Can any of your readers give me the reasons and a remedy?

Is it not partly, at least, due to the stretching of the cable and its recovery, due to difference in strain and causing slipping on the drums? If each successive groove was made slightly smaller, would it not obviate this difficulty? How much smaller would they need to be? How much power would be consumed and wear caused by the increased bending of the cable? Was this the cause of the extra wear of the cable? In the case mentioned the drums were 16-inch diameter and cable $\frac{7}{8}$-inch. In the machine I am engaged on the drums are to be 22 inches to center of cable and $\frac{7}{8}$-inch cable. If these drums are placed close together, will they work satisfactorily without inclining their shafts to each other?

If any of your readers can give me any information on these points, I would appreciate it.

H. L. REYNOLDS.

Seattle, Wash.

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Furnishing Packing for Stuffing Boxes.

Editor American Machinist:

Some weeks ago Mr. Dunbar, in the columns of the "American Machinist," raised the question as to the proper depth of stuffing boxes. His query raised an old one in my mind. It was this: Why should an engine or pump builder send out an unfinished product? Why should the purchaser of a steam engine be forced to buy something to fill up a hole in the cylinder before he can use it? There would be just as much reason in asking him to buy a cylinder head, or a crosshead pin, as in asking him to fill the annular hole around the piston rod. The builder puts a packing around the piston that he believes will not leak and that will last for years. Why does he not do the same for

the piston rod? Can it be possible that he thinks the purchaser knows more about that part of the work than the builder himself?

I think it is late enough in the nineteenth century for a man to be able to buy a "ready-to-run" engine, just as he can buy a "ready-to-wear" coat, and not be obliged to pay out quite a sum for packings, etc.

F. L. JOHNSON.

Lynn, Mass.

[It is the general practice of engine builders to remove the packing from stuffing boxes after testing the engines and before shipping, and there is a good reason for it. The packing, if left in, rusts the rod, often leaving an unsightly ring that does not disappear for a long time. —Ed.]

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The Driving Power of Keys—Mr. Ramsbottom and His Inventions.

Editor American Machinist:

It is rather difficult to answer your question of how much dependence was placed upon the sides of the keys for driving. The sides of the keys were, of course, parallel with each other, and were an easy fit in the keyways. The taper on the top of the key was ⅛ inch to the foot, as given by Mr. Jones; and the entire formula, as given by him, was, and I believe is now, in general use.

If one will draw an arc of a circle about the center of the shaft, touching the corners of the keyway, he will see that the wheel cannot rotate on the shaft in either direction without compressing the metal of the hub or the key especially at one or the other of those points; and this, I take it, is the reason why the key is made broad instead of square in section. If the resistance of the metal to shearing were relied upon, the key would probably be made square or round.

Mr. Jones, in his article, speaks of sinking the key in the shaft. My practice has been an improvement on that. I always enlarged the shaft to receive both the wheel and the crank, for which latter purpose the shaft had always before been reduced. The enlargement enables the keyway to be planed through and the key to be conveniently driven in and out, it being entirely above the surface of the shaft or the journal. Also, the key, being further from the axis of the shaft, has its efficiency increased in the same proportion. For this reason, and the more perfect seating of the shaft in the hub, as described in my previous article, I never had a flywheel come loose in a rolling mill.

This construction has also this advantage, that planing out the keyways does not weaken or spring the shaft.

Returning to the subject of the eccentric piston ring, I wish to do justice to Mr. Ramsbottom and to render my tribute of admiration to the great engineer of the London & Northwestern Railway. He was one of the originating minds to whom the world is indebted for everything. Among his inventions I would note the following: The flying-rope system, for operating overhead travelers; this was first employed by him in the railway shops at Crewe, and has maintained its position in common use until superseded by electricity. The trough by which the water tanks of express locomotives are refilled at full speed; this, I fancy, will never be superseded. The automatic cylinder lubricator; this I would especially mention, for in the multitude of improvements its origin is liable to be lost sight of. For the locomotive service, for which Mr. Ramsbottom designed it, I doubt, indeed, if his construction has ever been improved on.

Respecting piston rings, Mr. Ramsbottom first conceived the fundamental ideas of an automatically expanding ring which should maintain contact with the cylinder at every point by its own elasticity, and of a narrow ring which would not batter the sides of its groove by its weight at high speeds, and of a ring that could be opened out to go over the end of the piston. In carrying these ideas into practice, he was embarrassed by two things—he could not trust English cast iron, and his thought did not get beyond a parallel ring, as nobody then did, or was likely to do until compelled to it, by finding that the parallel ring would not answer.

He made wrought-iron rings (steel was not then arrived at for such uses) which were rolled by ingenious mechanism, devised by him, into a form that was not a circle, but which would be a circle when compressed into the cylinder. The method by which this form was arrived at was described to me by Mr. Webb, who was then Mr. Ramsbottom's assistant: A ring turned to the size of the cylinder was cut on one side, and laid on a table and opened out by a number of cords extending radially from equidistant points. These passed over pulleys at the edge of the table and were loaded with equal weights. When the ring was judged to be expanded sufficiently, its outlines were marked on the table.

I used the rings in the first Porter-Allen engines, but found them to wear completely in two at points two inches to four inches removed from each end. In this predicament, I thought of modifying the ring by making it eccentric and of cast-iron, and in this form the ring has given complete satisfaction.

CHAS. T. PORTER.

[We are informed by Mr. Porter that orders have recently been issued at the works of the De La Vergne Refrigerating Machine Company, N. Y., to bore all flywheels according to the plan recently described in our columns by him.—Ed.]

Shopmen in Engineering Schools.

Editor American Machinist:

In commenting on my letter printed in your issue of March 26th you say: "We cannot agree . . . . that 'it is wholly impracticable to grant a student credit for shop work done elsewhere,' and least of all for the reasons given." I fully agree with you in this, and had no intention of making such a statement. My sentence was: "With the usual arrangement of classes divided up into years, and with a set order of studies, it is wholly impracticable to grant a student credit for shop work done elsewhere, allow him to devote the equivalent time to making up deficiences, and then put him through the school in the usual length of time." This does not at all say it is impracticable to grant credit for shop work done outside, but that, even with these credits granted, the student deficient in preparation cannot under existing schedules get through college in the usual time. Therefore I say in my second letter, which appeared in your issue of April 16th: "The remedy for these evils is simple but effective. It consists in abolishing entirely the arbitrary division of classes and the ironclad courses of the past, and substituting an elective system of studies." It is therefore clear that I am not urging the preservation of existing schedules, but rather a complete change to fit them to our present requirements. This is exactly in line with your comment, and I think that our ideas on this matter are substantially the same.

EDGAR KIDWELL.

[Mr. Kidwell's aims are so entirely in accord with what we have been urging that it seems almost ungracious to differ from him as to methods. It does not seem to us that it is necessary to abolish the distinctions of courses or classes in order to bring engineering education within reach of men from the shops; but if Mr. Kidwell finds that he can best accomplish the object in that manner, we can only wish him God speed in his efforts.—Ed.]

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Reversed Momentum.

Editor American Machinist:

There is something in the "reversed momentum" mentioned by your English correspondent, W. A. Carlile, in your issue of April 23d.

A passenger standing in the aisle of a railway carriage will, when the air brakes are applied, have a tendency to fall forwards, towards the engine. He braces himself naturally against this tendency by leaning backward. The retardation of the speed of the train continues at an approximately constant rate, and to counteract it he continues, although unconsciously, to lean backward. Suddenly, when the speed of the train becomes zero, the retardation ceases. The man still leaning backward, finds his center of gravity un-

supported, and if he has not braced himself by holding onto a seat, or otherwise, may fall backward.

Being a "commuter," I have frequently experienced the unpleasant sensation of reversed momentum, but I have never heard or seen an explanation of it.

WM. KENT.

Passaic, N. J.

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Power Calculation for a Traveling Crane.

Editor American Machinist:

I note in your issue of April 23d a correspondent's criticism of a statement in my recent article on "Crane Power." Your editorial remarks as appended are pertinent and from the correct standpoint. The bridge acceleration is, however, not uniform or nearly so, but it need not be discussed here.

To consider at once the case cited by your correspondent as "taken from actual practice," he figures 53 horse-power net at the wheel as necessary to maintain the crane at speed. He then takes pains to emphasize this by calling attention to the fact that "no margin is allowed for losses by friction in gearing, shafting, etc." How, then, could it be expected that a 50 horse-power motor would even run the crane, to say nothing of starting it, when the work required is by his own figures and statement 53 horse-power plus an allowance for friction losses in transmission? If the gearing efficiency to the motor were high—say 90 per cent.—53 horse-power at the wheel would call for 59 horse-power at the motor, and it strikes me as a very sensible piece of engineering to put in a 60 horse-power motor when there is about that amount of work to do.

If the case had been my own, I should not have dared to rely on getting 90 per cent. efficiency out of the gears, but your correspondent seems to have done it, for he states that when the 60 horse-power was put in "the trouble ceased to exist." I beg to state here that one of the most vital points in successfully proportioning the size of a crane bridge motor is to give it an ample margin of power. In many respects it is the hardest-worked motor on the crane, one of its severest strains being a reversal under load, which it is sure to receive at times, in spite of any precautions to the contrary.

To return to the discussion, if the 60 horse-power motor started and accelerated the crane satisfactorily, and if it took 53 horse-power and more to keep it in motion when once started, then we have the case before us of a motor nominally large enough only to maintain speed, exerting an extra effort in starting and accelerating to that speed. If that statement doesn't sound familiar to your correspondent, he can examine his own quotation of my sentence to which he takes exception. It seems to me as though he had unwittingly proven my point; although he has apparently proven, or rather assumed, that the longer and more inefficient the gearing train, the easier the work on the motor.

The running load of a motor is the torque and consequent current which it will stand for an indefinite period without dangerous heating. Those familiar with motor design or specification know that the starting torque can be and is specified at a certain percentage larger than the running torque. Often a certain figure is given for a definite space of time. I used to have in my notebook a table by the Westinghouse Co., in which they stated for the motors we used a certain torque which could safely be exerted for four minutes, and which was considerably in excess of the rated running torque. Torque means current, and current means heat, and heat means time; and within the time limit we must keep. Hence, I reaffirm my original statement which your correspondent has questioned, and, moreover, deny that "very few motors are able to work with an overload of 50 per cent." Not all motors will stand this—perhaps not even a majority—and in any case it is perhaps wise to specify clearly what is understood by the running load. I myself have tested a great many Westinghouse motors to far above their rated torque, and have subsequently used them to traverse crane bridges. Moreover, I have myself designed and built several hundred slow-speed multipolar crane motors which would easily stand a 50 per cent. overload. That they were not wasteful of copper and therefore unduly expensive, I will say that the cost of the motor equipment for a crane did not increase from their use.

I should be much interested to see the crane in operation which your correspondent writes about, as it is remarkably out of the ordinary line. His figure of 100 tons for the total weight must include the load, although he does not say so. As a guess, the net load at the block may be 50 tons. Hence, supposing 700 feet per minute to be speed under load, the reduction of motor effort under no load perhaps runs the speed up to 900 feet per minute, or about 15 feet per second. This is pretty fast, but with no load at the block is not so remarkable as nearly 12 feet per second with 50 tons or so suspended in the air by a swaying connection. When the current is shut off under a speed of 700 feet per minute, the mass will travel about 170 feet, working against friction alone before coming to rest. If brakes are applied, there is the pendulum action to contend with, which one who has watched the stopping of loads under even slow speed can realize is considerable, even though he may not have held a guy rope. Loads of 50 tons are handled much like a basket of eggs, if such a comparison is allowable, and when they are handled otherwise a big risk is on. In my own experience, which has covered estimates for some 500 cranes, of all sizes and for all kinds of service, the favorite speed has been about 300 feet per minute light, and 200 feet per minute loaded. It takes a long shop to be able to use more speed than this. In several instances I know of the specified speed being met and afterwards being cut down to suit the purchaser.

I have no desire to start a discussion or question the performance of the crane upon which your correspondent bases his figures. I would, however, like to see a test of it published, or to learn of its location and service.

CHAS. L. GRIFFIN.

Springfield, Mass.

▲ ▲ ▲

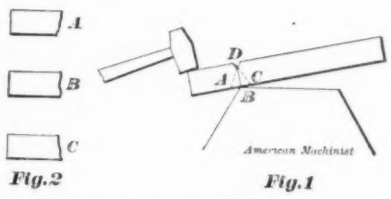


Fig. 2 *Fig. 1*

THREE WAYS TO DO IT.

Breaking off a Piece.

Editor American Machinist:

In your issue of March 5th, Tecumseh Swift asks which is the best way to break a bar of any metal which has been nicked on one side to start the break. I should not break it in either of the two ways he describes, but should hold the bar as shown in Fig. 1, so that the line *D B*, joining the nick and the point of support on the anvil, is the shortest possible; that is, so that *D B* is perpendicular to the edge of the bar.

I tried the experiment of breaking in different ways a bar of chilled cast iron, and found that when held in this way the bar broke squarely off, as shown at *B* in Fig. 2. When held in either of the other positions, so that the point of support was *A* or *C*, the line of fracture tended to follow the line joining the nick with the fulcrum, and the break was slanting, as shown in *A* and *C*, Fig. 2.

As to the ease of breaking, the lever arm of the end struck by the hammer is longest when the fulcrum is at *C*; hence the blow needed would be lightest and the bar would hold the hardest when supported in this manner, and of course the opposite would be true when the fulcrum is at *A*. Hence the bar would no doubt break easiest with the fulcrum at *C* were it not for the fact that when in that position the bar is sheared somewhat instead of breaking squarely, as when supported at *B*, so that it is doubtful if *D B* is not the line of easiest fracture. However, this point seems to be so fine that it cannot be definitely determined without the aid of a microscope.

SPIRAL.

Holding Wheels with Set Screws.

Editor American Machinist:

There seems to be among your correspondents some who think that to attempt to secure fly-wheels with set screws is not good mechanical practice. If we consider the percentage of wheels so fastened which get loose, the practice does not seem to be so very unmechanical after all. The case mentioned by Mr. Crane, where the screws were spaced around the hub, was certainly unmechanical. With anything like a fair fit between shaft and hub, set screws will hold a wheel securely under the severest conditions. The side fit is something that should never be allowed in a key, except the hub be either shrunk or pressed onto the shaft. In such cases it matters little whether there be any key or not, if the fit is properly made.

Your English correspondent, Mr. Phillips, speaks of a key which could be pushed out with the fingers after the set screws were loosened, and condemns the practice. Now, that particular key was just as it should be; and had it not been for the screws on the opposite side which counteracted the effect of the two on the key, he would have had no trouble. Mr. Crane's case was almost identical with that of Mr. Phillips. Builders often make the mistake of putting in pointed screws where severe work is expected. The flat-ended screw will hold better than any other, and I have never understood why any other kind was ever used. They do not burr the shaft, and do not break off little bits that stick and make trouble.

F. L. JOHNSON.

Lynn, Mass.

▲ ▲ ▲

United States Revenue Cutter No. 3.

By the kindness of Capt. John W. Collins, Engineer-in-Chief of the United States Revenue Cutter Service, we are enabled to lay before our readers some interesting drawings of Revenue Cutter No. 3, intended for duty upon the Pacific Coast. This vessel is now being built at Messrs. Cramp's ship-yard, and when completed will cost about $230,000. It is expected that an exactly similar vessel will be built to be stationed at New York, a bill to authorize it being now before Congress.

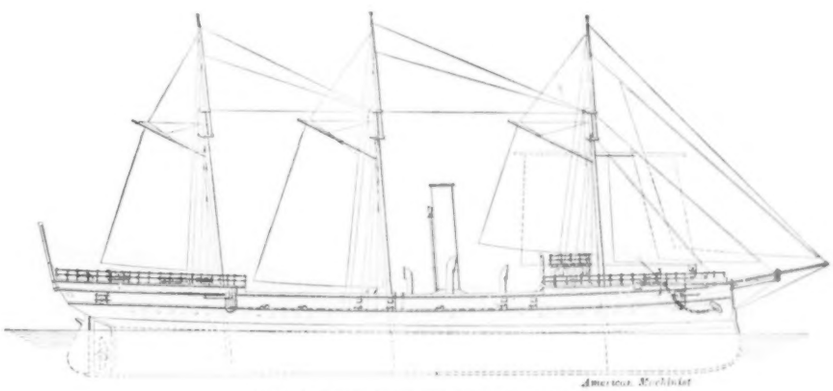
The principal dimensions of the vessel are: Length over all, 219 feet; between perpendiculars, 200 feet; breadth of beam, molded, 32 feet 6 inches—extreme, 33 feet 4 inches; depth of hold, from top of flat keelson plate to top of main-deck beams amidships, 17 feet 10¼ inches; displacement to mean draft of 14 feet above bottom of keel, 1,280 tons.

The vessel, as will be seen from Fig. 1, is to have considerable sail power, her rig being that of a three-masted schooner, with a square sail at the foremast, and a total sail area of about 8,000 square feet.

All plates and shapes used in the construction of the hull will be of open-hearth steel, and the rivets of open-hearth or Clapp-Griffith steel. Stringent rules and directions are provided for the inspection of all the material.

THE ENGINES.

Although the hull of the modern vessel, as also the rigging and every important component, is a product of the iron or steel worker's art, we are still, and naturally, most interested in the engines and boilers. The main engine (a single screw being employed) will be of the vertical, inverted-cylinder, direct-acting, triple-expansion type; the cylinders being, respectively, 25 inches, 37½ inches and 56¼ inches in diameter, and 30 inches stroke The working steam pressure will be 160 pounds, and the collective indicated horse-power of the main engines, with that of the air pump and circulating pump engines, will be 2,000 when the screw is making about 160 turns per minute. A piston valve will be used for the high-pressure cylinder, and double-ported slide valves for the intermediate and low-pressure, all operated by double bar links. Each main piston has a single piston rod, with a crosshead working on a slipper guide.



A SEA-GOING REVENUE CUTTER.

The bed plate of the entire engine is to consist of a single casting. Each cylinder will be supported at the back on a cast-iron column which forms below a section of the condenser. At the front each cylinder is supported by a forged-steel column. The cast-iron columns will be fitted for the crosshead slipper guide, and will have a separate water back for circulation.

The cylinder castings will each include valve chest, steam ports and passages, lower heads and the various brackets for attaching to the several supports. The cylinders will be solidly bolted to each other, the centers being 4 feet 9 inches and 5 feet 6½ inches fore and aft of the intermediate. Each cylinder barrel is to be 1¼ inches thick, and to have a lining 1⅛ inches thick, the lining fitting the casing at the top and bottom of the cylinder and near the middle, and having a flange turned inward at the bottom, by which it is fastened to the bottom of the cylinder with round-headed, counter-sunk, steel tap bolts. A stuffing box at the top of the lining allows for expansion and also makes the joint tight. The linings are to be as hard as can be bored with Mushet steel, and they are to be finally bored after they are secured in the cylinder, and with the cylinder vertical.

The intermediate and low-pressure cylinders are to be steam-jacketed, reducing valves and safety valves allowing a pressure from 20 to 80 pounds in the intermediate, and from 0 to 30 pounds in the low-pressure jacket. The water drained from the jacket will be piped to both the feed tank and the bilge.

The pistons are to be of cast steel, with followers of cast iron, and packing rings, two in each, ⅝ inch wide and ¾ inch thick, cut obliquely and tongued and set out by steel springs. The piston rods will be of forged steel 5 inches in diameter, with taper fit in both piston and crosshead, and a nut on each end. The rod at the upper end will have a collar, 6 inches diameter and 1 inch thick, sunk into the piston.

The piston valve of the high-pressure cylinder will be 16 inches diameter, the valve chest having a renewable casing of hard cast iron. The valve will have packing rings, of a style not specified, and the lining of the chest will have alternating right and left diagonal bridges. The weights of all the valves will be balanced. The steam and exhaust laps of the several valves will be as follows:

HIGH-PRESSURE CYLINDER.

Steam lap: Top, $1\frac{3}{64}$ inches; bottom, $1\frac{7}{16}$ inches.

Exhaust lap: Top, minus $\frac{1}{32}$ inch; bottom, minus $\frac{1}{32}$ inch.

INTERMEDIATE CYLINDER.

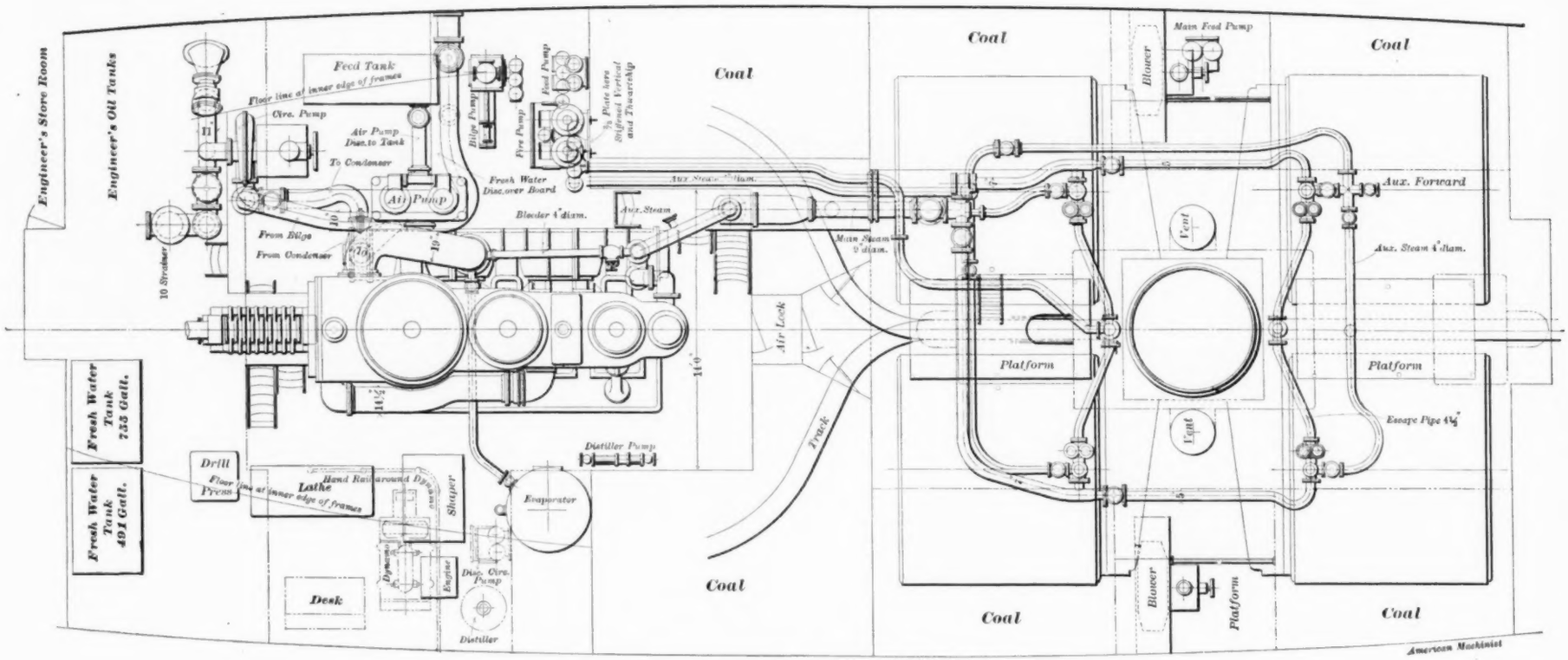
Steam lap; Top, $1\frac{3}{64}$ inches; bottom, $1\frac{7}{16}$ inches.

Exhaust lap: Top, minus $\frac{9}{16}$ inch; bottom, $1\frac{7}{16}$ inches.

LOW-PRESSURE CYLINDER.

Steam lap: Top, $1\frac{3}{4}$ inches; bottom, $1\frac{9}{16}$ inches.

Exhaust lap: Top, plus $\frac{1}{32}$ inch; bottom, plus $\frac{1}{16}$ inch.



REVENUE CUTTER No. 3. GENERAL ARRANGEMENT OF MACHINERY.

The connecting rods will be forked, the body round, and 5 inches diameter at the upper and 6½ inches diameter at the lower end; 75 inches between centers.

The crank shaft will be in two sections, one crank on the forward and two on the after section, the shaft at the journals being 10½ inches in diameter and the crank pins being the same. The angles of the cranks will be 120 degrees, the high pressure leading and the intermediate and the low pressure following in succession. The thrust shaft will be 9¾ inches diameter, with 9 collars 15½ inches diameter, 1¾ inches thick and spaces of 3½ inches. There will be an intermediate shaft 28 feet long, and the propeller shaft, which will be 10½ inches diameter and "the length to be taken from the work." The propeller shaft will be covered with a composition casing from the propeller boss to 6 inches inside the stern stuffing box, shrunk on in sections 30 inches long. The casing will vary from ¾ inch to ½ inch in thickness.

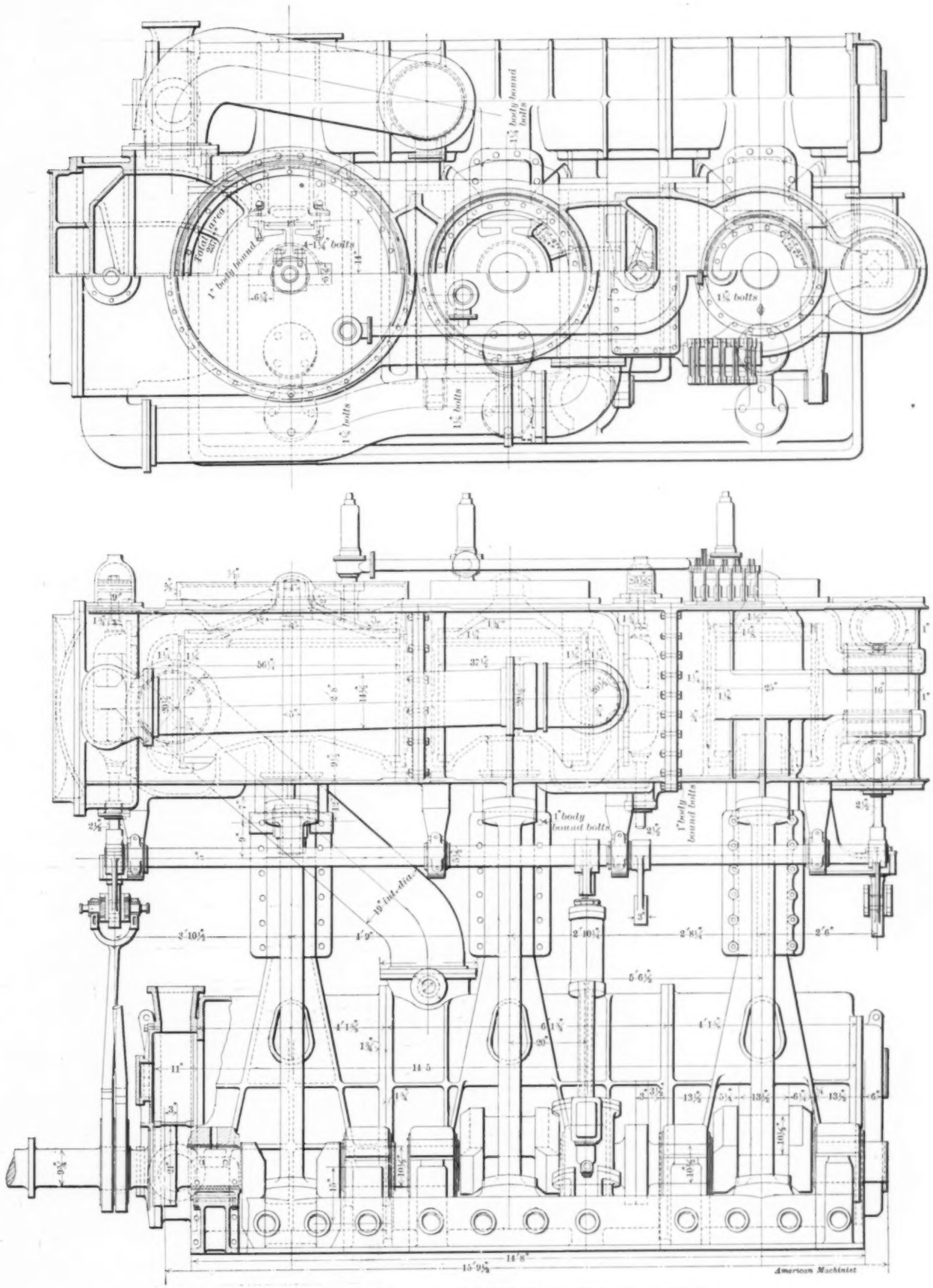
The propeller will be of manganese bronze, right-handed, with four blades, and 12 feet diameter "with pitch and helicoidal area as directed." The center of the blades at the periphery will be 1 foot aft of the center of the hub. The propeller will be held by a feather 2¼ x 1⅜ inches and a steel nut locked on the end of the shaft.

The condenser will be of rectangular shape, cylindrical top and bottom, of cast iron and 1 inch thick. It will be about 16 feet 3 inches long, 5 feet 2 inches high, and 2 feet 9½ inches in breadth. The tube sheets will be of composition ⅞ inch thick, with 1,253 seamless-drawn Muntz metal tubes, ⅝ inch outside diameter and No. 18 B. W. G. in thickness, tinned outside and inside, 14 feet 5 inches long and spaced $\frac{15}{16}$ inch between centers. The cooling surface will be about 3,000 square feet, measured on the outside of the tubes.

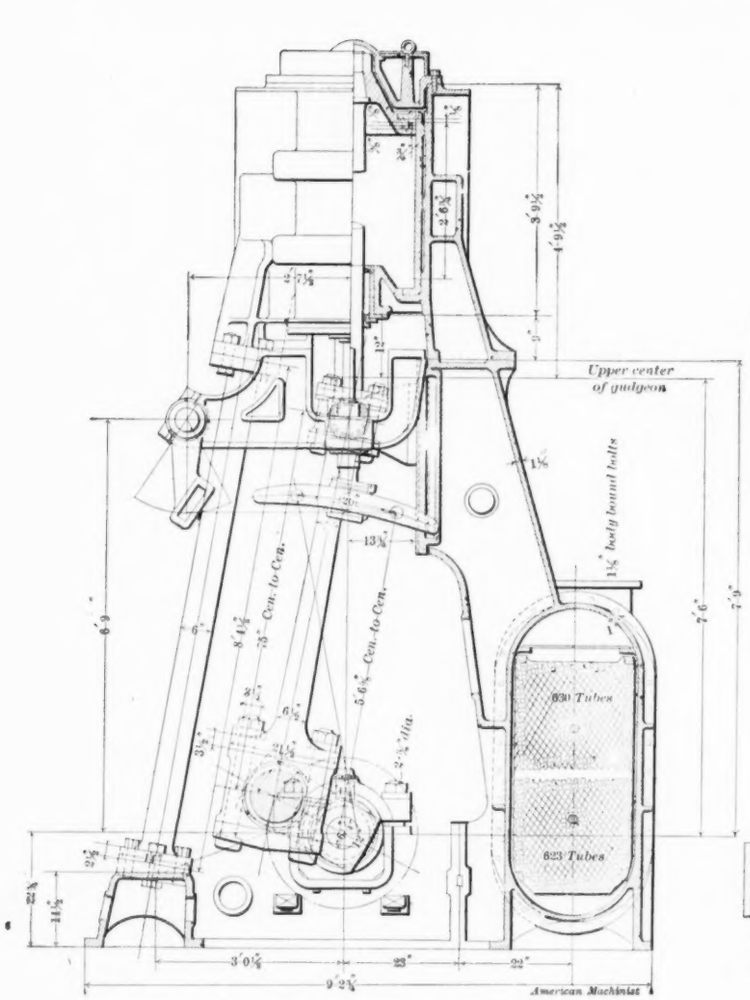
The air pump will be independent, with two direct-acting vertical steam cylinders 9 inches diameter by 12 inches stroke, and two single-acting vertical air pumps 20 inches diameter by 12 inches stroke. The circulating pump will be centrifugal and driven by a vertical engine 8 inches diameter by 8 inches stroke. The main feed pump will also be independent—vertical duplex—with steam cylinders 8 x 12 and water cylinders 5 x 12. The suction will be 3½ inches and the delivery 3 inches. A duplicate of this pump will also be provided and located in the engine room. There will also be a distiller circulating pump, a fire, a bilge and a hand pump and a bilge ejector.

BOILERS.

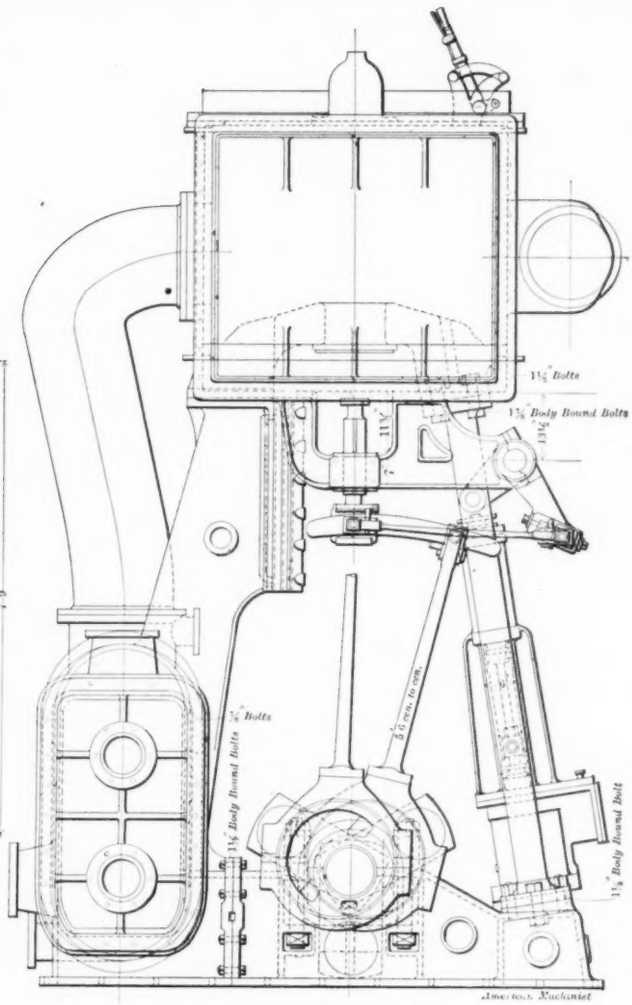
There will be four single-ended boilers



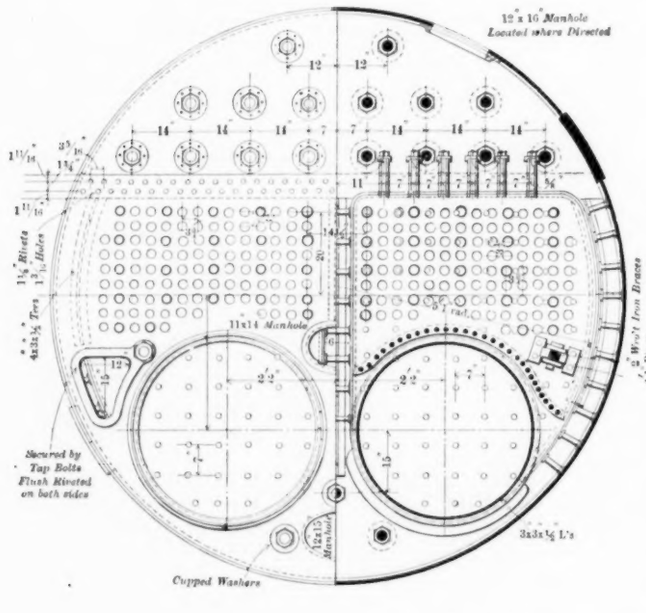
REVENUE CUTTER No. 3. PLAN AND ELEVATION OF ENGINES.

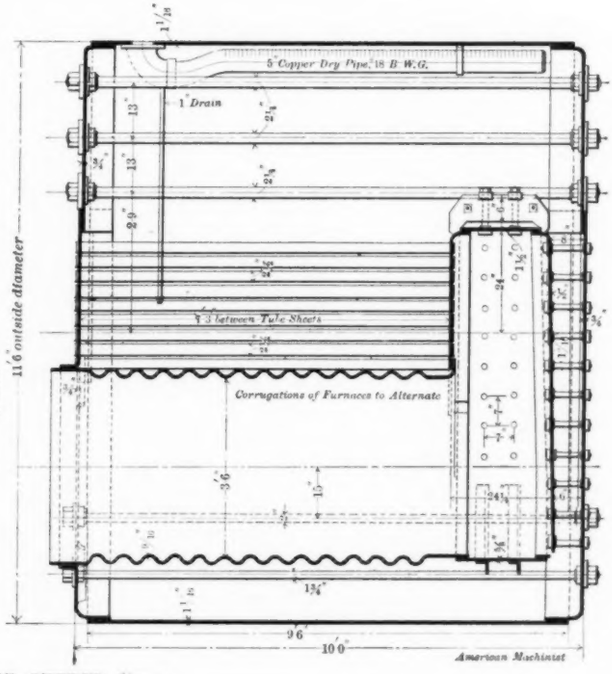


FORWARD END.



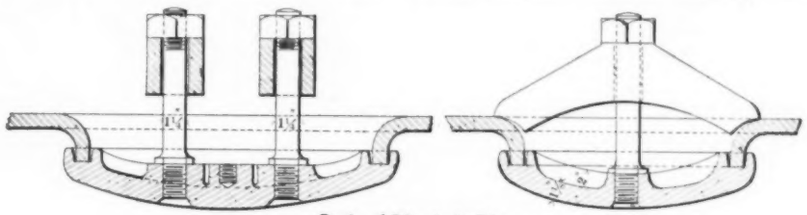
AFTER END.


12" x 16" Manhole Located where Directed
11x14 Manhole
Secured by Tap Bolts Flush Riveted on both sides
Cupped Washers
3x3x½ L's

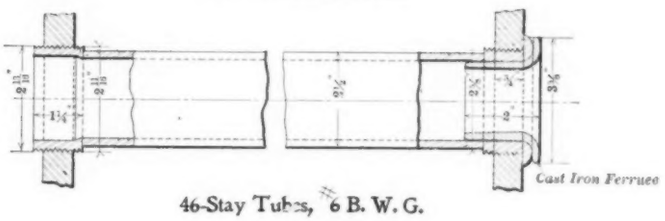


BOILERS OF REVENUE CUTTER No. 3.

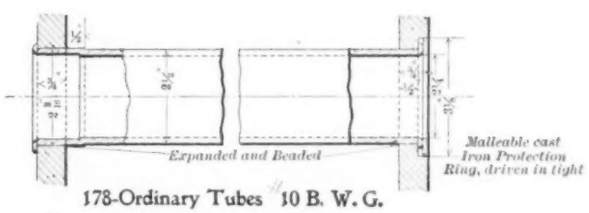
of the horizontal-return fire-tube type, 11 feet 6 inches outside diameter and 10 feet long. They will have a total heating surface of about 5,200 square feet, and a grate surface of 168 square feet. Each boiler will have two corrugated furnaces 3 feet 6 inches internal diameter. The plates and rivets will be of open-hearth steel. The shell will be $1\frac{1}{16}$ inch thick and will be made of a single course, each course consisting of two plates butted, making each plate about 18 feet by 10 feet. Each head will be made of two plates ¾ inch thick. The front heads will be flanged outwardly at the furnaces, and all heads will be flanged inwardly at the periphery; the heads will also be stiffened with T-bars. The tubes will be 2½ inches external diameter, and the ordinary tubes will be swelled to $2\frac{9}{16}$ at the front end. The back ends will be expanded in the tube sheets, beaded over into a counterbore which will be fitted with a ring, or they will be otherwise protected from the flame. The ordinary tubes will be No. 10 B. W. G., while the stay tubes will be No. 6 B. W. G., and reinforced at both ends to $2\frac{5}{8}$ inches, the front ends being then swelled to 2¾ inches. They will be threaded parallel (12 threads) at the combustion chamber ends, and taper at front ends. After they are screwed in tight in the front ends, they will be made tight at the back by expanding and beading. Cast-iron ferrules will be used to protect the ends of stay tubes in the combustion chambers. The tubes will all be spaced 3½ inches, centers, vertically and 3¾ inches horizontally. The longitudinal joints of the boiler shells will be butted with 1-inch straps outside and ¾-inch inside, and treble-riveted. The joints of the heads, and of the heads with the shells, will be double-riveted, and the joints in furnaces and combustion chambers will be single-riveted. The edges of all plates in the cylindrical shells and of all flat plates will be planed. The plates in the cylindrical shells are not to be sheared nearer the finished line than one-half the thickness of the plate along the circumferential seams, and not nearer than one thickness along the longitudinal seams. All rivet holes in the shell plates will be drilled in place after bending, and after the holes have been drilled the plates will be separated and the burrs around the holes trimmed off. Hydraulic riveting will be used wherever possible, with a pressure of 65 to 75 tons, and where hydraulic riveting cannot be used the rivet holes will be tapered on the driven side $\frac{1}{16}$ inch.



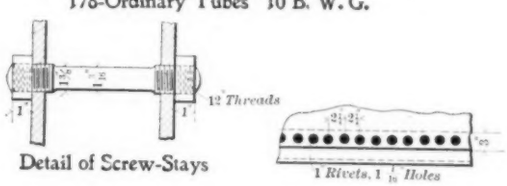
Style of Manhole Plates



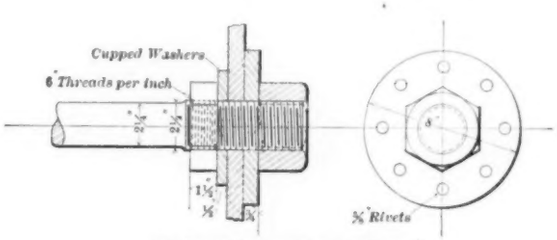
46-Stay Tubes, 6 B. W. G.



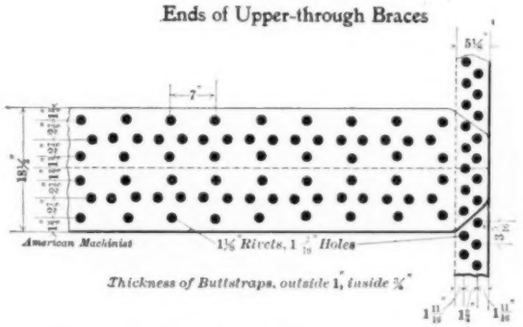
178-Ordinary Tubes 10 B. W. G.



Detail of Screw-Stays



Ends of Upper-through Braces



DETAILS OF BOILERS, REVENUE CUTTER No. 3.

Our space will not permit us to go further into the details of the boiler construction, nor of the various attachments to be provided. Each boiler will have a steam stop valve, an auxiliary stop valve, dry pipe, main-feed check valve, auxiliary-feed check valve, surface blow valve and bottom blow valve—all with internal pipes, two safety valves, steam gage, glass water gage—automatically closing, four asbestos-packed gage cocks, sentinel valve, salinometer pot, drain cock and air cock. Then there will be blowers and all the arrangements for forced draft, and means for transporting and handling the fuel.

Of the electric light plant and many other refinements of modern life afloat or ashore, it is not necessary to speak. The vessel, as a whole, is an extremely interesting one, and we are confident that it will be creditable to the designer and a valuable addition to the service.

▲ ▲ ▲

A plan of Prof. Wm. T. Magruder's, Chief of the Machinery Department at the Tennessee Exposition, is to have a waterfall over 50 feet high. The steam pumps exhibited will pump the water for this, and color effects will be used *a la* electric fountain. Means will be provided by which the water delivered by any particular pump can be accurately measured, and it is expected that the arrangement will be appreciated by pump exhibitors, as well as by the public.

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Better Prices for Machinery.

When our editorial entitled "Who Should Raise Prices of Machinery," printed in our issue of April 16th, was written, we had in mind one particular manufacturer and his line of machinery, but the correspondence called out by this shows that the same principles apply to several other lines of machinery as well, and we have letters saying that we must have been at various specified places, making a study of various specified lines of the machine business, for the shoe exactly fits A or B or C, and "we hope he will read the article and profit by it."

We hope so, too; for we know very well that prices are really too low in several lines of machinery—lower than is consistent with good work, good materials, fair interest on value of plant, and fair compensation to workmen and their employers.

We know, too, that one of the strongest, if not the very strongest, depressing influences comes from the managers of some of the largest and most influential establishments, who seem to consider it their duty to capture every order in sight, if possible, even when already crowded with orders, and to do it by cutting prices; and they then complain that prices are too low, but that they can see no prospect of improvement, or that if there is to be any improvement it will not take place until a new Administration comes in.

Suppose, instead of pursuing this course, large manufacturing concerns should, when they find themselves fairly well filled with orders, advance quotations a little, and be content if this advance causes an occasional order to escape them. Would this not result in a general stiffening of prices in most cases? If it would not, then we must confess we can see no prospect of an improvement until every shop in the land, large and small, has more than it can do; and several new Administrations may come and go before we see that condition of affairs, to say nothing of the fact that, as past experience shows, such a condition does not usually continue very long even when it does show itself.

We should remember that Providence helps those who help themselves, and that if those who are engaged in a given line of business will not do what commercial conditions permit them to do, looking toward improvement, then a betterment of conditions is indeed in the dim, distant future.

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Increase of Drilling Speeds.

Most machinists will unhesitatingly declare that they know how to drill holes in iron and steel. Collectively they do, of course, know all that is known about it; but nevertheless recent developments seem to indicate that relatively few of them know how to make a twist drill do the greatest possible amount of work, because ideas and practice in that branch of the machinist's business are just now undergoing a change.

Most drillers will affirm that the speeds given in the catalog of the Morse Twist Drill & Machine Company, and freely copied elsewhere, are about right; but these figures will probably soon be changed as a result of recent tests, and there are those who declare that they hardly give even a hint of the most advantageous speeds for Morse drills.

We quote from the Morse table as follows:

Diameter of Drill.	Speed for Wrought Iron and Steel.	Speed for Cast Iron.
1/16	1,712	2,383
1/8	855	1,191
3/16	571	794
1/4	397	565
5/16	318	452
3/8	265	377
7/16	227	323
1/2	183	267
1	76	115
1½	46	74
2	31	51

The average is a little over 21 feet per minute, and it will be noticed that the speed per minute decreases with increased diameter of drills.

Below we give a table of speeds that are being used in the Brown & Sharpe Mfg. Co.'s shops:

Diameter of Drill.	Wrought Iron or Steel.	Cast Iron.
1/16	4,200	5,500
1/8	2 000	2,500
3/16	1,200	1,550
1/4	900	1,100
5/16	650	825
3/8	500	625
7/16	400	500
1/2	325	400

By comparison it will be seen that these speeds average considerably more than twice as high, and they have been developed under conditions which we regard as likely to show what the very best speeds are, all things considered; because they represent the practice of contractors who buy their own drills, and therefore balance speed of actual drilling against cost of drills, and find out by experience the most advantageous speeds.

Prentice Bros., of Worcester, have also been paying considerable attention to this matter, and, by greatly increasing rotative speeds and at the same time decreasing feeds, have in some cases, such as bicycle drop forgings, reduced the time of drilling a given hole from 7 minutes to 1 minute, and in numerous other cases have, by such changes, greatly increased production and at the same time made drills stand the work better.

The fact seems to be that the speeds ordinarily given to tools cutting metals do not apply to drills in most cases, and the fact that small drills are run at higher peripheral speeds is probably accountable for by the fact that they have a much greater surface for the absorption and conduction of heat in proportion to the amount of metal removed by them, the surface of a cylinder being proportional to its diameter, while its solid contents are in proportion to the square of its diameter; so that while a quarter-inch drill presents one-half as much surface to the work as a half-inch drill does, it removes only one-fourth as much metal per revolution at the same feed.

It is to be noted especially that feeds have been decreased with this increased speed. Mr. Prentice recommends feeds of two or three thousandths per revolution in steel, but with very high rotative speeds; and operated thus, he finds that drills keep comparatively cool, stand well, drill very fast and do better work—the latter because they are not nearly so likely to be crowded out of alignment—and the machine or fixture is not forced out of its proper position by the force required to feed a large drill taking a heavy chip.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(98) E. F. V., Montreal, Can., asks: Do you know of any way to anneal chilled cast iron? A.—Chilled iron, or iron which has been cast upon a chill, cannot be annealed, as far as we know. Hard cast iron is sometimes softened by packing in charcoal and keeping at a red heat for a long time—say several days—but it is almost invariably cheaper and better to make another casting.

(99) G. M. H., Toledo, O., writes: Suppose we have a bicycle with large sprocket wheel 5 inches in diameter, and that the length of the crank is 6½ inches, what pressure would be required on the pedal to bring a stress of 1,200 pounds upon the chain? A.—The weight required would be inversely proportional to the radius or length of the crank and the radius of the sprocket wheel, and the expression in the form of a proportion would be, 6.5 : 2.5 :: 1,200 pounds is to the required weight, and this reduced gives a weight of 461 pounds.

(100) J. W. D., Christy Park, Pa., asks: 1. Can you give me any calculations for computing a battery?

A.—Let N = total number of cells;
n = number of cells in a row in series;
e = E. M. F. of one cell;
r = resistance of one cell;
l = external resistance.

Then $\frac{N}{n}$ = number of cells in a row in multiple, and

$$\text{current} = \frac{n\,e}{\frac{n^2\,l}{N} + l.}$$

2. Name some good batteries. A.—For closed circuits, any standard gravity battery. For open circuits, the Sampson or the Patrick & Carter carbon battery. 3. What are the elements mostly used in closed circuit bateries? A.—Copper and zinc. 4. How many volts can be obtained from one battery? A.—Different batteries vary between about one and two volts per cell. A good commercial battery should give nearly or quite one and a half volts per cell.

(101) H. C. asks: What will be the deflection of a shaft 16 inches diameter, 14 feet between centers of bearings, with a load of 100,000 pounds on the center of it? A.—The deflection of a beam of any cross-section is found approximately by the following formula:

$$\frac{W \times L^3 \times d}{E \times I}$$

W is the weight in pounds, L the length or span in inches; d is a co-efficient which, for this case, a beam suported at both ends with center load, is .02083; E is the modulus of elasticity, which for cast-iron we may take at 15,000,000; I is the moment of inertia, which for a circle is $r^4 \times .7854$. Substituting all the values, we have:

$$\frac{100000 \times 168^3 \times .02083}{15000000 \times 8^4 \times .7854} = .204$$

To this should be added the deflection due to the weight of the shaft itself, although in this case it would be but .01 inch. The operation is as follows: d being changed in this case, for a beam uniformly loaded, to .01302, and the weight of the shaft being computed at 9,458 pounds

$$\frac{9458 \times 168^3 \times .01302}{15000000 \times 8^4 \times .7854} = .012$$

and the total deflection then will be .204 + .012 = .216 inches.

▲ ▲ ▲

The New York City Civil Service Board will hold the following examinations at its office in the New Criminal Court Building, at 10 A. M. on the following dates:

May 11th—Building Inspector and Inspector of Iron and Steel. The law requires that "The inspectors shall be competent men, either architects, civil engineers, masons, carpenters or iron-workers, who shall have served at least ten years as such."

May 14th—Computer.

May 18th—Mechanical Engineer.

The examinations will consist of Writing, Arithmetic, Technical Knowledge and Experience. Citizens of the United States, eighteen years of age and over, are eligible to examination. Applications may be obtained by addressing S. William Briscoe, Secretary, New Criminal Court Building, New York City.

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The interesting "Practical Letter" in our issue of April 23d, upon the "Value of Published Tests of Steam Boilers," the signature to which was unaccountably omitted, was by Mr. H. E. Fisher, Ware, Mass.

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Business Specials.

Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Adding Machine. Grant: see page 26.

Forming Lathes, Mer. Mach. Tool Co., Meriden, C.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Honest Mach. Oils. F. S. Pease Oil Co., Buffalo, N. Y.

Engine Castings ¼ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Best Presses and Dies for all sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

Just Issued—Catalog 8. No. Mailed free. Clayton Air Compressor Works, 28 Cortlandt st., New York.

Bevel and miter gears cut with perfect planed teeth. Boston Gear Works, Boston, Mass.

Aluminum and Brass Castings, Machinery, Name Plates. Twining Campbell, Paterson, N. J.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

Form'g and reliev'g lathes for back'g off formed cutters; gear cutters for cutting 2 teeth at a time, any pitch, 2 to 48. R. M. Clough, New Haven, Ct.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

For Sale—A fair sized foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; located on a railroad; within eight miles of New York. Can be seen in operation for few weeks only. Owners giving up business. Terms easy. Call or address Room No. 41, 22 William street, New York.

Commercial Review.

NEW YORK, SATURDAY EVENING, MAY 2d.

The Machinery Market.

Judging from the tone of leading handlers of iron working machinery in this city, the market shows a continued pertinacity in extreme conservatism. It is difficult to see how the outlook has altered during April, except that every succeeding month of quietude is another nail driven into the coffin of enthusiasm. From the general weight of evidence it may be inferred that trade is unimproved, and some people even find it a little duller just now than it was a few weeks ago.

Although this is now a relatively inactive season for bicycle manufacturing tools, we understand that, of the trade of one house in a general line of tools, some 75 or 80 per cent. is derived from that source. The season for a revival of buying of machinery for that purpose is said to be about June or July; but, as we have before intimated, this rush into the business of making bicycles is being overdone, and it is only a question of time—and not necessarily a long time either—how soon the market will become surfeited with them. One seller of medium-sized machines of a general nature, other than for bicycle work, finds a little encouragement after a long period of depression. Another representative of a well-known company pronounces the market easier, and that of the various kinds of tools, screw machines are still in about the best demand. The remark is made that tool making mechanics are in some requisition, which may be taken as a hopeful sign.

Prices still rule at low figures.

This is the active season for woodworking machinery, and consequently some people are selling more than hitherto, but it is denied very flatly by someone in a position to judge that there is any far-reaching improvement in the situation.

We have received the following letter from a Massachusetts machinery firm:

"We find that our own business and that of the manufacturers with whom we are associated has fallen off very materially, this month, from the average of the first three months of the year. The bicycle manufacturers are not ordering very much, this month, which accounts, to a large extent, for the falling off in our business. There is still quite a lot of business being done with the bicycle manufacturers, but nearly all the business that we are getting is for the lighter lines of tools. Lathes above 18 inches swing are selling very slowly. We do not think that the trade this month (April) will be any more, if as much as in April, 1895. We do not feel any apprehension on account of the present dullness of trade, although the present condition of things, taken apart from other circumstances, looks very bad. The writer thinks that we are

only passing through one of the phases of business that must be expected after such a panic as we had in 1893, and confidently looks for a very large increase in business in 1897. In the past, we have never recovered from a panic in our business until the fourth year, and we ought not to expect it this time."

The Newton Machine Tool Works, of Philadelphia, write: "While we have received considerably more orders during the month of April, prices are very low. Our prospect in business seems to be bright at the present time. While we do not anticipate very much business this year, we think that at the beginning of next year, business will undoubtedly resume its normal condition."

A certain Connecticut company tell us that they are very busy and have been for a year and a half; too busy, in fact, to ascertain the condition of other tool manufacturers, though they are told that some are very actively employed and some quite slack. This is just what we have for some time noticed to be the case.

Pittsburg Report for April.

There is no question that the general machinery market has improved during the past month. Manufacturers who have been contemplating alterations in their works for a long time past, have been inviting bids for machinery of all kinds and descriptions.

The bright and cheerful side of the trade is just beginning to assert itself, and were it not for the tightness of money the market would be in an extremely healthy condition. Still, there are to be found some agents of boiler and engine concerns who still complain of the poor market, but these are getting fewer each day.

The Duquesne Theatre is installing a very complete electric light plant, to consist of a McEwen engine, direct connected with Thomson-Ryan generators, etc. At this writing the contract for boilers has not yet been awarded, but it is probable that the McNaull safety water tube will be installed. A 200 horse-power heater of the Pittsburg design, made by the Pittsburg Feed Water Heater & Engineering Company, will also be placed in this plant. Another electric light plant is to be erected at Etna Borough, for which Lea & Carroll, of this city, are the engineers. There have not been any contracts awarded as yet, bids being only closed a few days ago. The city of McKeesport also intends to erect an electric light plant of its own, and is now seeking proposals for the same. F. W. Patterson, of that city, is the engineer, and he will receive bids for the construction of the plant and the entire equipment of the same.

Reports from Youngstown are that the Lloyd Booth Company has given a leading machinery firm of New York City, a contract for several heavy traveling cranes, also for lathes, etc. Many im-

Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Foreman boiler maker wants position. A 1 references. Address I. J., AMERICAN MACHINIST.

Wanted—Pos. as draftsman by tech. grad. with shop and drawing office exp. S. W., AM. MACH.

Situation by experienced mech. draftsman. Address H. A. H., 814 Fulton street, Brooklyn, N. Y.

Machinists for light brass and iron work. Best references. Rushmore Dynamo Works, Jersey City.

Mechanical assistant draftsman is open for engagement. Best references. G. L., AM. MACHINIST.

Pattern maker wants situation, thor'ly exper'd in engine, tool and general work. H. M., AM. MACH.

Draftsman and pattern-maker, with shop and drawing room exp. wants pos. Box 103, AM. MACH.

Situation wanted by experienced mechanic and skilled draftsman. Address Tool, AM. MACHINIST.

Mechl. engr., technical trained, 12 yrs., exp. as machinist, des'r and as foreman of drawing room, wants responsible position. Box 100, AM. MACH.

Wanted—Two draftsmen, aged about 35 years; those exper'd in automatic mach. and hopper feed work preferred. Box 107, AMERICAN MACHINIST.

Exp. brass f'ndry f'man would like to correspond with parties requiring the services of a competent man. Add., Up-to-Date, care AMER. MACHINIST.

Position wanted as general foreman or supt.; experienced tool maker and machinist; 12 years in charge and piece work prices. Box 102. AM. MACH.

Pattern maker desires pos. as foreman in a mfg. company. Exp. in pump and engine wks. and gen'l mach. pat'ns. Sober & energetic. V. S., AM. MACH

Wanted—A first-class steel salesman for merchant mill. State salary expected and where employed. Address by mail only, B. B., 89 Tribune Building, New York City.

Assistant foreman wanted in a Corliss eng. shop near New York; one well up on tool work. Address, giving age, experience and references, Foreman, Box 96, AMERICAN MACHINIST.

Machinist, with 16 years' experience in tools and engine work, 7 yrs.' experience on piece work, also expert in thread cutting, would like to change position. Box 106, AMERICAN MACHINIST.

Wanted — Experienced mechanical draftsmen, North and West, having evenings free. State where regularly employed. Edwin Guthrie, Patent Attorney, Corcoran Building, Washington, D. C.

Change of pos. wanted by a technical grad. with 7 yrs. practical exp. on high-grade engs., mining machy. and tools. Understands mining, metallurgy and chemistry. Good refs. H. M., care AM. MACH

Mech. draftsman, age 24; technical graduate and shop exp.; has had several years' experience on tools, fixtures and engine design, wants position; best of references. Box 104, AMERICAN MACHINIST.

Steady position wanted by thoroughly practical and up-to-date pattern maker (Swedish); 8 years' experience with leading manufacturers in this country. Best of reference, sober, and willing to work. Address J. N., AMERICAN MACHINIST.

Mechanic, age 50, with long exp. as form'n, supt., constructing engr., dftsman and desig'r in special and gen. mach. works wants similar pos. Middle, Western or Southern States preferred; highest references. Mechanic, 48 Clifton ave., Chicago, Ill.

"Refrigerating Machinery," containing the general principles of refrigerating and ice-making machinery, by Geo. Richmond, M. E., mailed free on receipt of 20 cents in stamps. American Engineering Pub. Co., 333 Adams street, Brooklyn, N. Y.

A large tool factory wants a thoroughly experienced engineer with college education and who is capable of acting as substitute for the technical director. First-class men will send their application, stating course of study, previous positions and references under S. 6148 to Rudolf Mosse, Vienna, to be forwarded.

Wanted—A man to act as traveling representative for a favorably known tool builder, to sell a labor-saving machine; previous experience as salesman not necessary, but good habits, good address, exp. in machine shop work and management required. Answers confidentially treated. Give full particulars as to previous ex. Box 105, AM. MACH.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York,Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by C. H. Baush & Harris Machine Tool Co.

Party with capital to take part interest in new and useful tool. R. B. W., AM. MACHINIST.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden st., Saginaw, Mich.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

For sale—5,000 half-worn drills and taps at 1 cent each. Send stamps for samples to J. L. Lucas, Lynn, Mass.

For Sale—Two Warner & Swasey speed lathes, in first-class condition. Penberthy Injector Co., Detroit, Mich.

A French engineer with money wishes to meet with owners of patents on high speed steam, gas, oil and petroleum motors, with the object of starting a works in France to make them. Address L. D., AMERICAN MACHINIST.

VALUABLE BOOKS

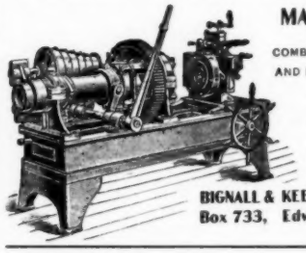
For MACHINISTS, ENGINEERS, ELECTRICIANS, Etc.

Our catalogues of Books, on the above subjects, as well as every other practical subject, sent free to any address.

☞ See our detailed advertisements of special books in recent numbers of AMERICAN MACHINIST.

NORMAN W. HENLEY & CO.,
15 Beekman Street, NEW YORK.

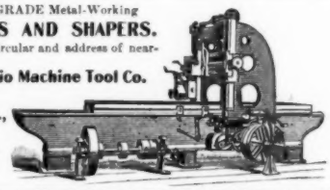
"PEERLESS" DUPLEX PIPE THREADING MACHINES.



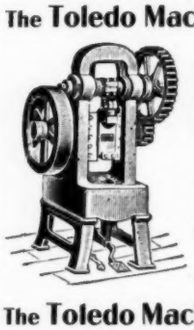
COMBINATION BENCH AND PIPE VISES.
CONTINUOUS FEED RATCHET DRILL.

BIGNALL & KEELER MFG. CO,
Box 733, Edwardsville, Ill.

HIGH GRADE Metal-Working
PLANERS AND SHAPERS.
Write for circular and address of nearest agent.
The Ohio Machine Tool Co.
600 South Leighton St.,
KENTON, OHIO.

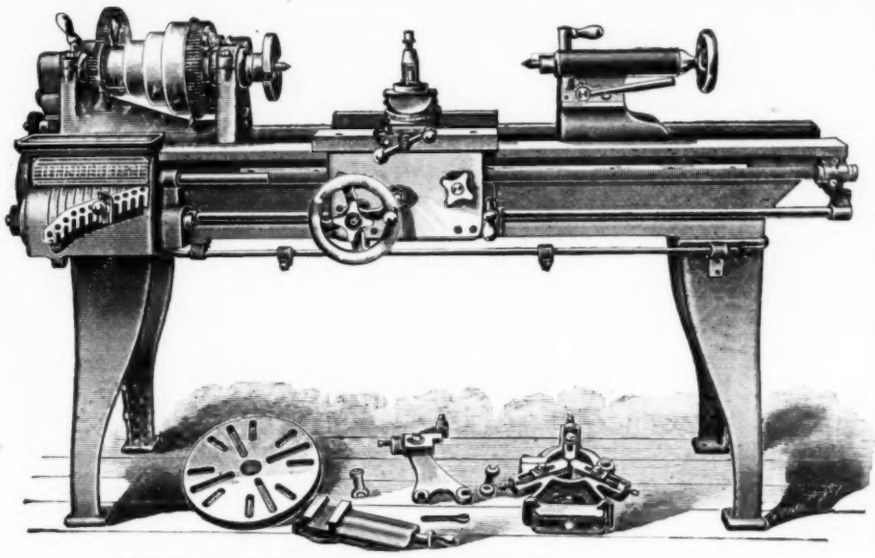


The Toledo Machine and Tool Co.



MANUFACTURERS OF
Power Punching, Drop, Trimming, Stamping, Riveting, Embossing Presses,
With Automatic Feeds.
MACHINES FOR WORKING BAR AND SHEET METALS.
Complete Outfits for Can Making.
SEND FOR CATALOGUE A.

The Toledo Machine and Tool Co.
OAK AND JACKSON AVE., TOLEDO, O., U.S.A.



14 in. x 6 ft. Hendey-Norton Lathe with Improved Automatic Stop.

THIS Lathe COMBINES the LATEST and BEST Improvements. Automatic Stop. It is Simple, Durable, Indispensable. It will AUTOMATICALLY STOP the Carriage in EITHER direction. It is equally efficient whether FEEDING or THREAD-CUTTING. Running up to a shoulder, boring to BOTTOM of holes, or INTERNAL THREAD-CUTTING.

No danger of spoiling either tool or work. It is a safeguard against accidents, in either direction.

Feeds — It has all feeds in daily use with simple movement of lever.

Threads — It has all threads in daily use with simple movement of lever.

Carriage — The carriage reverses in Apron. No slamming of Countershaft. There is no comparison between this Lathe and the old style or common Lathe. Quick work, rapid changes, satisfactory results. BUY THE BEST.

SEND FOR CIRCULAR.

The Hendey Machine Co.

TORRINGTON, CONN.

European Agents:

CHAS. CHURCHILL & CO. (Ltd.),
21 Cross Street, Finsbury, London.

SCHUCHARDT & SCHUTTE,
59 Spandauerstrasse, Berlin.

SOLLER, Basel, Switzerland.

provements are being made in the company's plant, including the erection of a new foundry and machine shop, etc. It is also stated that the New Castle Steel & Tin Plate Company will erect a plant to make its own steel, which will be one of the most thoroughly equipped in the country. These improvements mean an outlay of several millions of dollars, and show that business is coming around to where it should have been months ago.

The demand for drills, planers, lathes, etc., is gradually assuming its former shape, and the past month has shown an improvement with many concerns handling such machinery. Orders are not heavy enough to last until July or August, but sufficiently large to keep shops running fairly full at present. One bad feature still clinging to this line is the low prices prevailing.

The mill supply market keeps going in its usual style. The call for such goods is of a regular character, and but little can be said of it.

It seems as if the bicycle trade is to be one of the chief industries in this section, as numerous new concerns are starting up for their manufacture on a large scale.

In the general iron and steel trades it can only be said that mills are mostly running to their capacity, and that the prospects are very fair for a continuance. Furnaces are producing heavily and the product is finding a ready market at slightly better prices. The action of the tin plate manufacturers in deciding to make an advance in prices has made prospects better for those who are endeavoring to fix higher prices in the soft steel market. No. 1 foundry iron has been selling at $12.75 @ $13.25 cash, and No. 2 at $12.00 @ $12.50. In the pipe line, orders are heavier and prices better, due probably to the favorable weather during the past few weeks. In other lines, business is of an encouraging nature, and owing to the season, prices are looking upward.

Quotations.

NEW YORK, Monday, May 4th.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 50@$13 25
No. 2 foundry, Northern	12 00 @ 12 50
No. 2 plain, Northern	11 00 @ 11 50
Gray Forge	11 25 @ 11 75
No. 1 foundry, Southern	11 75 @ 12 00
No. 2 foundry, Southern	11 25 @ 11 50
No. 3 Southern	10 75 @ 11 00
No. 1 soft, Southern	11 25 @ 11 50
No. 2 soft, Southern	11 00 @ 11 25
Foundry forge, Southern	10 25 @ 10 50

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.20 @ 1.30c.; refined, 1.30 @ 1.45c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 10¾@ 11c.; electrolytic, 10½ @ ¾c.; casting copper, 10⅛ @ 10⅜c.

Pig Tin—For 5 and 10-ton lots, 13.45 @ 13.50c., f. o. b.

Pig Lead—In carloads, 3 02½ @ 3.05c., f. o. b.

Spelter—In carload lots, New York delivery, about 4.05 @ 4.10c., for ordinary brands.

Antimony—Cookson's, 7¼ @ 7¾c.; Hallett's, 6¾ @ 6¾c.; Japanese, 6¾ @ 6¾c.

Lard Oil—Prime city, present make, 49 @ 50c., in carload lots.

Manufactures.

J. H. Everhart, Newport, Perry Co., Pa., is building a flour mill and will put in machinery.

The LaRose Car Brake Company will be located in New Bedford, Mass. The capital will be $50,000.

The new brass foundry just established by Bowman & Co., has been located in South Harrisburg, Pa.

G. L. Andrews & Co., of Birmingham, Ala., are erecting a brass foundry, and will put in machine tools.

Johnson & McMaster, Landsdale, Pa., will start a wire nail and bale tie factory and will put in machinery.

S. W. Card & Co., machinists, of Mansfield, Mass., are going to build an addition of 100 feet to their shop.

A. C. Godshall & Co., Landsdale, Pa., will build a large addition to their flour mills and will put in new machinery.

The Business Men's Association, of Pinconning, Mich., will build and thoroughly equip a 200-barrel per day flouring mill.

Brown & Snyder, of Punxsutawny, Pa., will build a large planing mill at Glen Campbell, Pa., and will put in new machinery.

The Harrisburg Chain Works, Harrisburg, Pa. will, in the near future, enlarge their plant and will need some new machinery.

Gorie & Ghent's saw mill, at Omer, Mich., will be thoroughly equipped with shingle, lath, heading and stave manufacturing machinery.

Mr. J. W. Fischer, of Fayette, Mo., has established a machine shop in that town for repairing machinery and is adding a foundry.

The Harrisburg Foundry and Machine Works, Harrisburg, Pa., are increasing their plant, and will put in additional lathes, planers, etc.

The Philadelphia Metallic Mfg. Co., of Coopersburg, Pa., will engage in the manufacture of office furniture. A full line of machinery will be needed.

D. G. Dietz, Berlin, Pa., will erect a factory for the manufacture of flour mill machinery and will put in gasoline engine, band saws and other machinery.

The National Cycle Mfg. Co., at Bay City, Mich., are building a large addition to their cycle factory. Hub lathes and other labor-saving machines will be installed.

The Bay City Furniture Mfg. Co., Bay City, Mich., will enlarge their plant at once. Machinery to thoroughly equip a chair and table department will be put in.

The Harrisburg Consumers' Brewing & Bottling Co. are erecting an immense brewery building, and will put in a boiler, engine, tanks, vats, ice machines, etc.

C. T. Keaner, A. J. West and others, of Atlanta, Ga., have incorporated the Atlanta Bicycle and Machine Works. They will equip their factory immediately with special tools.

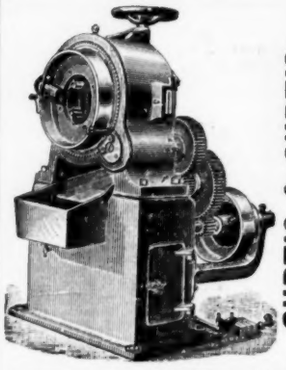
Daniel Mehan is building a new boiler works at Franklin, Pa. He will add new machinery of the most improved type for the speedy manufacture of boilers for the oil well trade.

Owing to the retirement of Mr. Long, of the Long & Jervis Foundry and Machine Co., Decatur, Ala., the business will be continued by, and known as the Jervis Foundry Machine Co.

The Pennsylvania Steel Co., Steelton, Pa., will erect a building for the manufacturing of tools, such as picks, shovels, etc., and will put in machinery for this line of manufacture.

The Steelton Brick Co., Steelton, Pa., who were burned out a short time since, are clearing away the debris and will begin on the new foundation at once, and will put in new machinery.

The Dunbar Furnace Co and the owners of the Columbia Steel Co. at Uniontown, Pa., have consolidated the two plants. They will manufacture billets independent of the steel pool.



CURTIS & CURTIS,
66 GARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery,
FOR HAND OR POWER,
RATCHET DRILLS, RATCHET DIE STOCKS AND
MALLEABLE IRON PIPE VISES.

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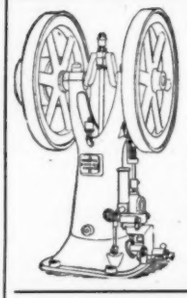

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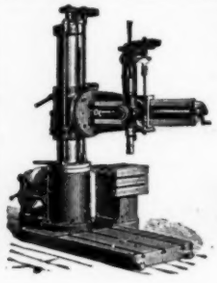

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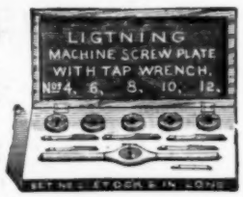

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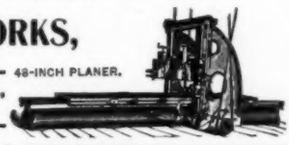

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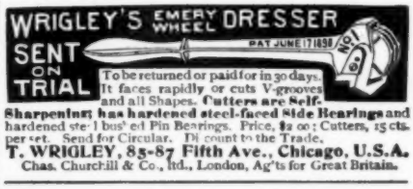
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The Barclow & Bull Mfg. Co., of Buffalo, N. Y., are remodeling the building formerly occupied by the Q. C. V. Barrel & Basket Co., and will soon be manufacturing brass and iron bedsteads.

The Ball Bearing Co., which has a newly equipped factory in Boston and has its main office in the Hancock Inspirator Company's building, has opened an office also at 51 Oliver street, Boston.

The Grey Iron Casting Co., Mount Joy, Pa., manufacturers of cast iron novelties, are building a new plant complete. They sold their old plant to the Pennsylvania Railroad Co., which purchased the same to use the ground.

The New York & Cleveland Gas Coal Co. will hereafter repair and build their own cars. The company will erect car shops at Turtle Creek, Pa., on the Pennsylvania Railroad. The new shops will employ about 50 men.

The Lackawanna Iron & Steel Company, Scranton, Pa., are building roasting ovens to cost over $140,000. When these are completed the roasting of the Cornwall ores will be done there instead of at Cornwall, Lebanon Co., Pa.

Mr. James McLaughlin recently with the Philadelphia Engineering Works, has been elected secretary and treasurer of the Barr Pumping Engine Company, Philadelphia. Mr. W. W. Lindsay is the general manager of the latter company.

Dawson & Goodwin, dealers in machine tools, at Chicago, Ill., have been obliged, owing to the growth of their business, to seek larger quarters, and have leased the four-story building, southwest corner of Canal and Washington streets, Chicago.

A company to manufacture furniture has been formed at Goderich, Ont., Canada. Mr. F. G. Rumball, hardwood lumber merchant, and Mr. Wm. Hinton, of the Kensington furniture factory, London, Ont., are among the stockholders, the latter as manager.

The new furnaces of the Franklin Steel Casting Co. were completed last week and are now in active operation. The company is rushed with orders and as soon as additional men skilled in the business can be secured the plant will be run double turns.

The Harrisburg Foundry & Machine Works, Harrisburg, Pa., has received an order and will build two 300-horse power engines for an electrical plant at Braintree, Mass. The company just made a shipment of two of their 300-horse power engines to the southern part of Italy.

Jenkins Bros., 71 John street, New York, have been making some improvements in their joint packing, and call the new product the "Jenkins '96." It is suitable for all pressures of steam, will not blow out, rot or squeeze out, and the joint can be broken and the packing used again.

The wood working mill at Capt. James Davidson's shipyard, at West Bay City, Mich., was destroyed by fire April 21st; $20,000 will be expended on new machinery, engine, small band saws, rip saws, trimmers, gang saw, planers, matchers and other wood-working machinery.

The present railroad suspension bridge at Niagara Falls, N. Y., is to be replaced with a steel bridge of three spans: end spans, 115 feet each; center span, 500 feet. There will be a double track, with roadway underneath. The bridge company are doing their own work on the foundations. Bids for the steel will be opened May 4th at the office of the company.

The Harrisburg Manufacturing & Boiler Co., Harrisburg, Pa., are running full time manufacturing their celebrated Star water tube and Star down draft boilers. They have also the contract for the making and erecting of a number of large self-supporting stacks for the Consolidated Gas Company, New Jersey. These stacks will be placed near the Atlantic coast.

The Jenkins Iron & Tool Co. has been organized at Bellefonte, Pa., for the manufacture of rakes and novelties. Work on the new plant will begin at once. Andrew Deitrich (of Baltimore) is president; secretary and treasurer, F. S. Chapin, of

Milton, Pa., and W. R. Jenkins, of Bellefonte, manager.

The Central Ohio & Pennsylvania Co. has completed the necessary terms whereby it will open extensive stone quarries at Brookfield, Trumbull Co., O., with its headquarters at Warren, O. A complete outfit of new machinery will be needed for the quarrying of hard stone by the latest methods.

Proposals are being invited until May 22, 1896, for steel-framed construction and repair shops at the United States Naval Station, Port Royal, S. C. Intending bidders can obtain plans and specifications upon application to E. O. Matthews, Chief, Bureau of Yards and Docks, Navy Department, Washington, D. C.

The West Chicago Park Commissioners are asking for bids for the steam power and electric light plant for lighting the West Chicago parks and boulevards, station, Garfield Park, Chicago, Ill. Water tube boilers, engines, etc., are required. Sealed proposals will be received by the committee, at their office in Union Park, until 4 o'clock P. M., Tuesday, May 12, 1896.

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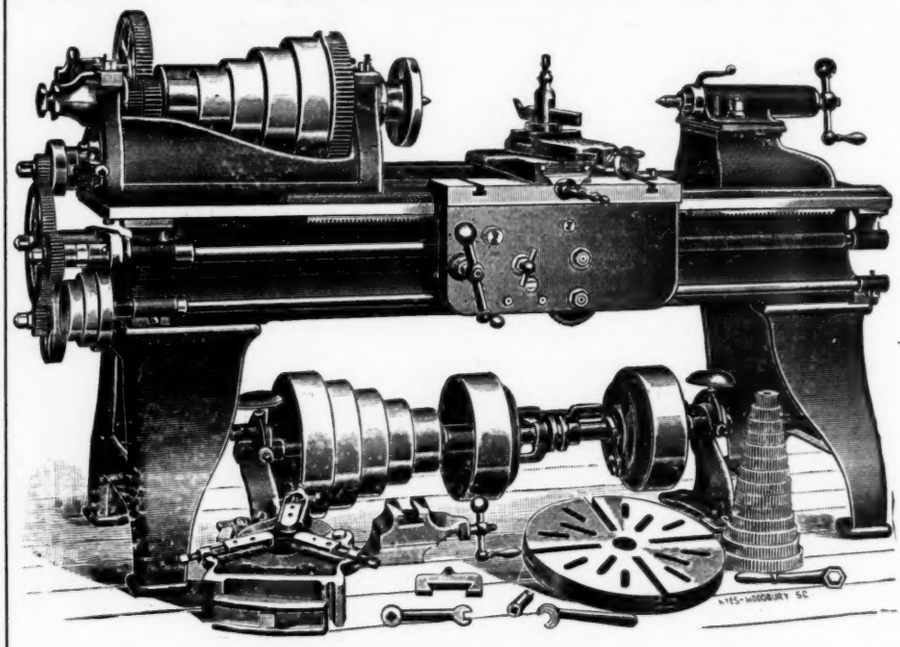

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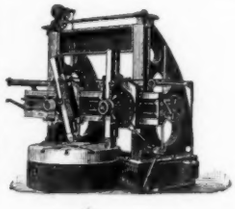

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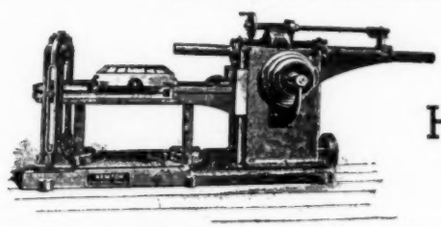

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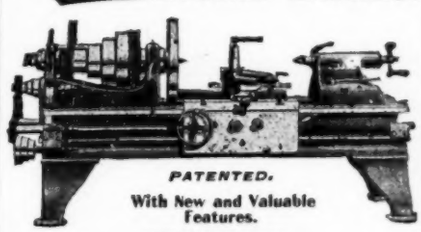

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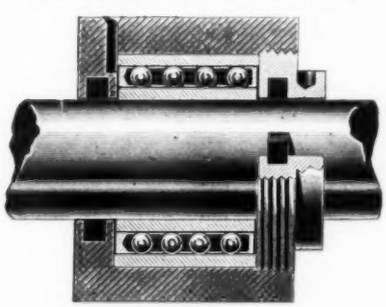

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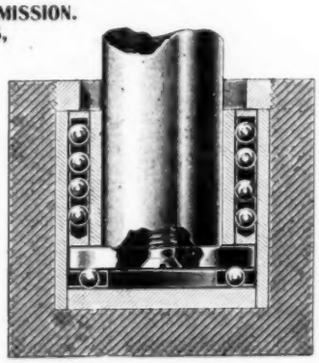

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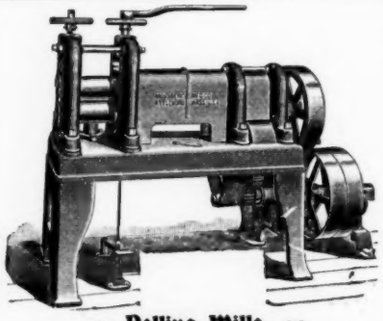

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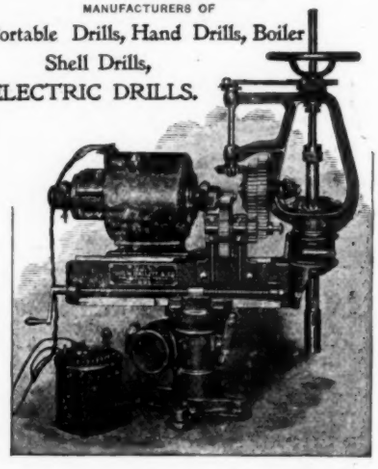

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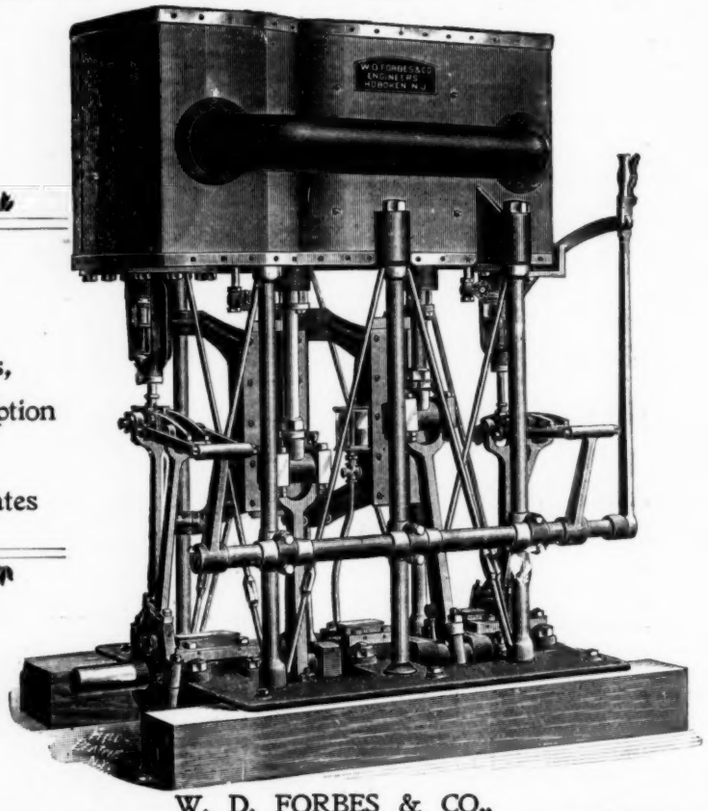

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Continued on page 30.

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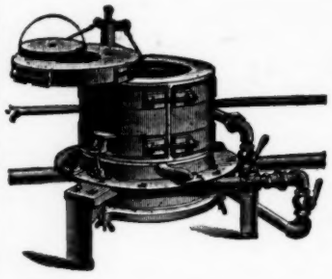

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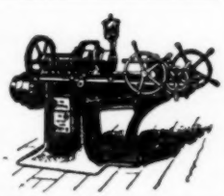

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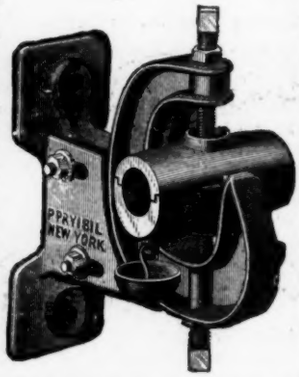

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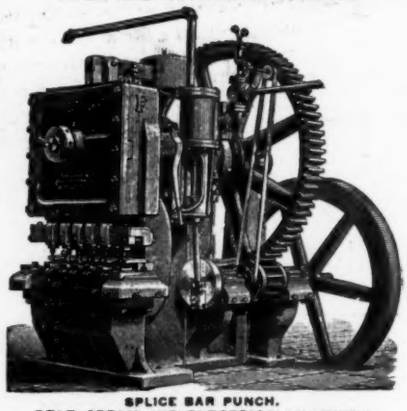

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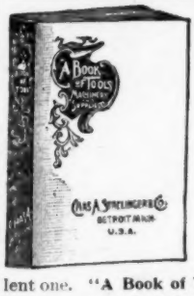

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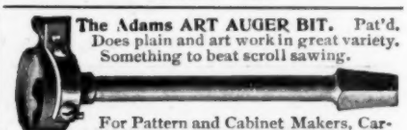

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